APPLETONS'
POPULAR SCIENCE
MONTHLY.

DECEMBER, 1896.

PRINCIPLES OF TAXATION.

By DAVID A. WELLS, LL.D., D.C.L.,
CORRESPONDANT DE L'INSTITUT DE FRANCE, ETC.

IV.—RELATION OF TAXATION TO THE STATE.

THE next step of importance in this discussion is to recognize clearly the relation which the exercise or function of taxation, as it has been defined, sustains to the state.

ORIGIN AND JUSTIFICATION OF TAXATION.—The question at once suggests itself, "By what right does that *entity* which we call the state, whatever may be its concrete form, and whether its powers are exercised by a single man (Cæsar), by a particular class, or by a majority of citizens, take from the individual that which hitherto was absolutely his, annul his ownership, and convert the thing of value to its own use?"* How happens it that the exercise of this right is so absolute that the state requires the citizen to set apart from the earnings of his labor a certain sum for its use before he applies any of those earnings to the support of his family? †

On this point there has been considerable speculation and philosophizing. It has been assumed that there must be an actual or implied contract between the state and the citizen, in virtue of which the state supplied a certain amount of protection to life

* "Titius is to render to Cæsar that which is Cæsar's. But when Cæsar comes to take the shock of wheat or the firstling of the flock Titius may well ask, as he gives them up, Why are they Cæsar's rather than mine? What right to them has Cæsar and not my neighbor Mævius?" Tyranny in Taxation. Theodore Bacon. New-Englander, 1867.

† The probate judiciary of the State of Connecticut has recently held that in the settlement of insolvent estates taxes due prior to the assignment of an assigning debtor should be regarded as preferred claims, and as such should be paid in full by the trustee.

and property, and for which the citizen in return pays an equivalent in money, merchandise, or personal service. There is, however, no historical example of any such contract.

Others have sought to refer the origin of this right on the part of the state to take the property of the citizen to an antecedent right of might, and have assumed that, as the ruling power, whether monarch or majority, is physically able to take and apply to its own use all that the individuals ruled over may call their own, it is therefore legitimate and morally correct for it to exercise this right and take such part of its subjects' property as it may see fit.

A *third* and more plausible theory is, that as all rights of property are conventional and not natural, and without the intervention of the state by its laws could not be enforced nor protected, and, indeed, could hardly be said to exist; therefore the state is the source of all title, and the individual holds only by grant or sufferance of the state. From these premises it follows that the state, in compelling contributions from its subjects, or, as is ordinarily expressed, in "taxing," is in the position of an absolute proprietor who takes simply what is his own. This was the theory accepted and practically carried out by all the monarchs of Europe in the seventeenth century, or about two hundred and fifty years ago, and defended by the best and most eminent men of the time, as Bossuet in France and most of the great jurists of England under Charles I, as was exemplified in the case of John Hampden, who was prosecuted for refusing to pay an arbitrary tax known as "ship money"; and the decision in which, by the High Court of Exchequer, placed the property of every Englishman at the disposal of the crown. It was also so clearly expressed by Louis XIV that his words are worthy of exact citation. Thus, in a manual which he wrote for the guidance of his heir and successor, the Dauphin, he says: "I hold the place of God. To me belong exclusively the lives and fortunes of my people. The nation resides entirely in the person of the monarch. Kings are absolute masters, and may naturally, fully and freely dispose of all the property possessed by either the clergy or laity, to use at all times like wise stewards and according to the needs of the state."

Herbert Spencer refers the growth of revenue, which involves the right to take it, from the outset, like the growth of political headship which it accompanies, directly or indirectly, to the results of war. "The property," he says, "of conquered enemies—at first goods, cattle, prisoners, and at a later stage land—coming in larger share to the leading warrior, increases his predominance. To secure his good will, which it is now important to do, propitiatory presents and help in labor are next given; and these,

as his power further grows, become periodic and compulsory, making him more despotic at the same time that it augments his kingdom. Continuance of this process increases his ability to enforce contributions, alike from his original subjects and from tributaries; while the necessity for supplies, now to defend his kingdoms, now to invade adjacent kingdoms, is ever made the plea for increasing his demands of established kinds and for making new ones. Under stress of the alleged needs, portions of their goods are taken from subjects whenever they are exposed to view for purpose of exchange. And as the primitive presents of property and labor, once voluntary and variable, but becoming compulsory and periodic, are eventually commuted to direct taxes; so those portions of the trades goods which were originally given for permission to trade, and then seized as of right, come eventually to be transferred into percentages of value paid as tolls and duties. But to the last as well as at first, and under free governments as under despotic ones, war continues to be the usual reason for imposing new taxes or increasing old ones, at the same time that the coercive organization, in past times developed by war, continues to be the means of exacting them."* Mr. Spencer further asserts that "in the early stages of social evolution nothing answering to revenue exists." These conclusions of Mr. Spencer seem, however, to be singularly imperfect, inasmuch as they do not appear to recognize that there can be such things as voluntary or beneficial taxes, or that society in order to exist would in the course of time institute taxation, even if there had been no war. He does, however, recognize that the increasing progress and complexity of civilization, by continually enlarging its sphere and functions, would continually necessitate an increase of taxation.

All such speculations and theories as to the origin and sphere of the rights of government in respect to appropriating the property of its subjects or citizens, although of philosophic interest, are, however, of no practical importance.† It is only necessary to recognize that in some form the organization or entity which we call the state exists for certain definite purposes, even though they be difficult of precise limitation; and to analyze the situation, as we find it, to obtain a satisfac-

---

* Abundant illustrations from historical or recent experiences of the successive stages of such assumed evolution of taxation are given by Mr. Spencer in the chapter On Revenue in his volume on Political Institutions.

† Edmund Burke, the great Irish statesman, is on record as characterizing any discussion of the abstract right of taxation in place of the actual facts of the situation, as belonging to the domain of political metaphysics, "a great Sorbonian bog in which armies whole have sunk," and that it was by fighting for such "a phantom, a quiddity, a theory that wants not only a substance but even a name," that English statesmen threw away their American colonies.

tory answer to the question at issue. For the command of a constant and adequate revenue being beyond dispute absolutely essential to the existence of organized government, the power to compel or enforce contributions from the people governed, or, as it is termed, "to tax," is inherent in and an incident of every sovereignty, and rests upon necessity.* The question of the obtaining of such revenue obviously, therefore, is the question of first importance in the economy of a state; the one in comparison with which all others are subordinate. For without revenue (and a government never has any resources except what it has obtained from the people), regularly and uniformly obtainable, no governmental machinery for the protection of life and property, through the dispensing of justice and the providing for the common defense, could long be maintained; and in default thereof production would stop or be reduced to a minimum, accumulations would cease or become speedily exhausted, and civilization would inevitably give place to barbarism and the wilderness. For like reasons also, or as the old-time Latin maxim, "*salus populi suprema lex*," concretely expresses it, the state holds command over the lives and liberties of its citizens equally as it does over their fortunes. In fact, the sovereignty of a state consists and exemplifies itself in the power to abridge the liberty of the individual citizen and to take his property; and the character of every government is mainly determined by the intent and purpose for which these two great functions from which all its force proceeds are exercised.

THE SPHERE OF TAXATION.—The sequence of these premises is no less important, or rather of transcendent importance; for if the power of taxation is an incident of sovereignty, as it confessedly is, then the *right to exercise that power must be coextensive with that of which it is the incident;* or, in other words, as the power of every *complete* sovereignty over the persons and property of its subjects is unlimited, the power, therefore, in every *such* sovereignty to compel contributions for the service of the

---

* "When we ask, What right has the state to infringe upon man's natural freedom? we are involved in the difficulty that there are no rights, in the strict sense of the term, antecedent to the state. All rights that we know anything about are either legal or moral. The right of the state to govern man can not be derived from law, for law is the creature of the state. If it is a moral right, it must rest on the same basis on which all morality rests, and this must be either conscience, or divine revelation, or utility. Of course, consent has nothing to do with morality. Conscience, furthermore, will not do as a basis for the state, for conscience does not enlighten us further than to let us know that we ought to obey the state if it is right to do so. Revelation, also, answered only so long as a direct and miraculous connection was believed to exist between human and divine authority. This leaves nothing but utility as the basis for the moral right of the state to interfere with man's natural freedom."—*Anonymous.*

state, or, as we term it, "*to tax*," must be unrestricted. "The power to tax is therefore the strongest and most pervading of all the powers of government, reaching directly or indirectly to all classes" (United States Supreme Court; Loan Association *vs.* Topeka, 20 Wallace, 655).

The power to tax, said Chief-Justice Marshall, in giving the opinion of the United States Supreme Court denying the right of Maryland to tax the Bank of the United States (McCulloch *vs.* Maryland, 4 Wheaton, pp. 316–431), "involves the power to destroy, and may be legitimately exercised on the objects to which it is applicable to the utmost extent to which the Government may choose to carry it." In the case of Weston *vs.* the City of Charleston, the same court, by the same eminent authority, also held that "*if the right to impose a tax exists, it is a right which, in its nature, acknowledges no limits. It may be carried to any extent within the jurisdiction of the State or corporation which imposes it, which the will of such State or corporation may prescribe.*" And in a more recent case (Loan Association *vs.* Topeka, 20 Wallace) the court, through the late Justice Miller, again expressed itself to the same effect as follows: "Given a purpose or object for which taxation may be lawfully used, and the extent of its exercise is in its very nature unlimited."

The government of a complete sovereignty can therefore tax all that it can lay hands on to enforce the tax—men, women, and children; all property and business—and the power may be exercised again and again until the subject taxed is exhausted or the privilege can be no longer exercised. This statement finds abundant illustration in history of people absolutely impoverished by taxation, and of individuals who have been sold into slavery because of their inability to pay the taxes that the state or ruling power had assessed upon them. The popular idea is that such examples of the extreme exercise of power on the part of the state to compel contributions have passed into history; but this is not the case. In every purely despotic Government there is no limitation on its exercise except such as arises from the inability of the subject to contribute. The head of the state—shah, czar, or emperor—decides how much shall be exacted and the time and manner of exaction; and not infrequently the amount taken is only a little short of what it is necessary to leave to the producer in order to enable him to maintain a mere animal existence. Thus in Russia the present governmental exaction—under the name of taxes—from the agricultural peasant is understood to amount to about forty-five per cent of his annual product or earnings.

In 1890 the excise taxation of Russia—which is mainly levied upon distilled spirits and other alcoholic drinks, tobacco, sugar,

kerosene, and matches—is reported to have amounted to seventy-five per cent of the value of the articles taxed. On the other hand, the Russian customs duties in the same year averaged but thirty-four per cent of the import value of the foreign goods imported—a circumstance that may find an explanation in the fact that a large proportion of imports of Russia are in the nature of machinery or crude materials for industrial use or elaboration, and apart from this the requirements of the masses in Russia for foreign products are comparatively small.

In Egypt until quite recently, as has been already shown (see previous chapter on The Tax Experiences of Egypt), the annual exactions from its peasantry—the fellahs—under the name of taxation produced an extremity of want which closely bordered on starvation.

In Italy, which in ancient times was regarded, as it is in fact to-day, potentially the richest country in Europe, and although its present Government can not fairly be characterized as despotic, its agriculture is burdened with state exactions that are reported as absorbing from one third to one half of the value of its annual product. The existing debt of the country, created largely by enormous military and naval expenditures, entails an annual interest charge of about $3.75 per head of its population.*

Another disastrous interference with the prosperity of the state is the system of taxing all business enterprises, after they have been established three years, at rates which in some cases swamp the profits. And in addition to such disturbing elements, there is undoubtedly an all-pervading evasion for a consideration of all forms of taxation by the functionaries whose business it is

---

* A national tax on movable (personal) property—the *ricchezza mobile*—is levied on the poorest of the Italian people; and often the bed has to be sold or the saucepans pawned to pay it.

The gate tax, *dazio consumo*, best known to English ears as *octroi*, which has been the especial object of the Sicilian fury, is a curse to the whole land. Nothing can pass the gates of any city or town without paying this odious and inquisitorial impost. Strings of cattle and of carts wait outside from midnight to morning, the poor beasts lying down in the winter mud and summer dust. Half the life of the country people is consumed in this senseless, cruel stoppage and struggle at the gates; a poor old woman can not take an egg her hen has laid, or a bit of spinning she has done, through the gates without paying for them The wretched live poultry wait half a day and a whole night cooped up in stifling crates or hung neck downward in a bunch on a nail; the oxen and calves are kept without food three or four days before their passage through the gates, that they may weigh less when put in the scales.

By this insensate method of taxation all the food taken into the cities and towns is deteriorated. The prating and interfering officers of hygiene do not attend to this, the greatest danger of all to health—that is, inflamed and injured animal and fowl carcasses sent into the markets. The municipalities exact the last centime from their prey; whole families are ruined and disappear through the exactions of their communes, who persist in squeezing what is already drained dry as a bone.—*Fortnightly Review, 1894.*

to collect the revenue. A very general feeling, therefore, naturally prevails that it is a laudable thing to cheat or rather rob the Government whenever opportunity offers.*

LIMITATIONS IN THE SPHERE OF TAXATION.—Attention is next asked to the fact that the foregoing propositions respecting the unlimited power of a state to compel contributions, or to tax, and which (as shown) have received the sanction of the highest judicial authorities, are predicated on the assumption of *complete* sovereignty on the part of the state. But in a truly free state such sovereignty does not exist, and the conditions which make it free necessarily preclude its existence. Thus in every such state the two great functions which constitute its sovereignty, namely, the right to interfere with the liberty of the citizen and with his property, have been called into existence and can be rightfully exercised for certain purposes only, which admit of precise definition. In such a state *the fundamental and essential purpose of government is not to abridge the liberty of the individual citizen in respect to his person, or his possession and use of property, but to increase it;* and this result (overlooked in a great degree by economists and legislators), as has already been pointed out, can only be attained by taking a part of the property of the citizen which the existence of the state has enabled him to acquire, for the purpose of maintaining instrumentalities for preventing any encroachment upon his rightful liberty and punishing those who attempt it. In fact, in every free state there are limitations on the exercise of the taxing power, growing out of the structure of

---

* It is enough to see how railways are built by the Government of Italy to form an idea of the openings afforded for rascality and fraud in their construction. "They are not built by contract, but on estimate. A building company estimates that a certain line will cost a certain sum and receives the job, which is always indeed a 'job.' The Government guarantees a certain income per kilometre, and the constructor makes the road as long as possible; but when the grant (which is made in bonds of the state) for the amount authorized is exhausted, the constructor coolly tells the ministry that the road must stop there unless the ministry makes another grant, which is of course done, and the invariable result is that the original estimate is nearly, or quite, or even more than doubled; with the consequence that none of the roads, as they are made, ever pay their expenses and interest on their cost of construction. More than that, they are so burdened with deadheads that it is estimated that only forty per cent of the passengers they carry pay full fare, the remaining sixty per cent paying from nothing up to seventy-five per cent of the fare. Deputies and senators travel free everywhere in the kingdom, but as the state pays a block sum for their privilege, it is not a dead loss, though, as every deputy who travels insists on having a whole compartment for himself, the road becomes anything but a profitable one. Every employee of the great systems of Italian railways has the right to make three journeys a year on each one, where he likes, and with his family, and the consequence is that some of them ruin themselves taking long railway journeys for which they have not the money to pay the expenses. And they are sixty thousand, with as many more pensioned off who have the same privilege; and, as all travelers know, the railway fare is the smallest part of the expense of a journey."—*Correspondence New York Evening Post, June, 1896.*

its government, or because it is free; or, as Chief-Justice Marshall expressed it, "by the implied reservations of individual rights growing out of the nature of a free government, and the maintenance of which is essential to its existence."

From the first dawn among the Anglo-Saxon race of the idea of a constitutional or free government, the necessity of establishing an inhibition on the power of government, in respect to the taking of property, was recognized; expressed or implied in the *Magna Charta*, and subsequently incorporated in the Federal Constitution, through its provisions respecting the equality of taxation, and that private property shall under no circumstances be taken for public uses without just compensation.

The necessity of a free state may, however, be so great—i. e., in the prosecution of war for national defense, or the maintenance of national existence—as to require that the entire resources of its people should be at the disposal of the Government, and compel a resort to taxation, even to the exhaustion of everything—property and business—which may be its objective; and in this sense—i. e., for the preservation of individual liberty and property—and in this sense only, is involved any inherent power or right in taxation to destroy. The nature of the principle involved also finds illustration in the circumstance that municipal authorities are warranted, in the case of extensive conflagrations, in absolutely destroying large amounts of property in the shape of buildings and their contents, in order to preserve a much larger amount of like property from destruction. The principle under discussion would not accordingly justify the use of taxation in time of peace (as has been exercised by the Federal Government of the United States) for the primary purpose of destruction, and not for revenue or the preservation of property. Clearly, if this right of taxation is unlimited, the property of every citizen would be subject to the absolute disposition and control of the depositary of power in the state for the time being; and the recognition or nonrecognition of such limitation marks, as before pointed out, more than any other one thing, the dividing line between a free government and a despotism.*

---

* "The dictum of Chief-Justice Marshall, used by this distinguished jurist in the heat of argument, has been adopted by many courts as justifying the uncontrolled exercise of the taxing power. A slight consideration will not justify the dictum. The proposition that the power to tax is the power to destroy is in opposition to the fundamental principles of a free government. It asserts the broad doctrine that the power to tax, one of the legislative powers, is unlimited and arbitrary. It is claimed that there is no such thing as arbitrary power in this country: that the form of government being republican, those who exercise the powers of government, whether executive, legislative, or judicial, are clothed with a trust which is not to be executed in accordance with a mere whim, or in an arbitrary manner, but according to the purpose of its creation."—*Burroughs's Law of Taxation*, 1877.

Probably the most weighty and concrete judicial opinion on this subject was that given by the Supreme Court of the United States in 1874 in the now celebrated case of the Loan Association *vs.* Topeka, 20 Wallace, in which the late Justice Miller, with the substantial concurrence of his associates, indorsed and amplified the opinion of Chief-Justice Marshall touching the reservation of individual rights under a free government as follows:

"It must be conceded," he said, "that there are rights in every free government beyond the control of the state. A government which recognized no such rights, which held the lives, the liberty, and the property of its citizens subject at all times to the absolute disposition and unbounded control of even the most democratic depositary of power, is after all but a despotism. The theory of our governments, State and national, is opposed to the deposit of unlimited power anywhere. The executive, the legislative, and the judicial branches of these governments are all of limited and defined powers. There are limitations of such powers which grow out of the essential nature of all free governments—implied reservations of individual rights, without which the social compact could not exist, which are respected by all governments entitled to the name. . . . Of all the powers conferred upon the Government that of taxation is most liable to abuse. Given a purpose or object for which taxation may be lawfully used, and the extent of its exercise is in its very nature unlimited. This power can as readily be employed against one class of individuals and in favor of another, so as to ruin the one class and give unlimited wealth and prosperity to the other, if there are no implied limitations of the uses for which the power may be exercised. *To lay with one hand the power of the Government on the property of the citizen, and with the other bestow it upon favored individuals to aid private enterprises and build up private fortunes, is none the less robbery because it is done under the forms of the law and is called taxation.* This is not legislation. It is a decree under legislative forms." And in the same case the same court declared that "the whole theory of our governments—State and national—is opposed to the deposit of unlimited power anywhere."

No one would probably question that if an assemblage of men reasonably intelligent—though not versed in law, political economy, or the teachings of social science—were to come together for the purpose of founding a state *de novo*, they would, while recognizing at once, and as it were instinctively, the necessity of insuring to the government of such state a revenue adequate to its support, never even so much as dream for one moment of intrusting to it a power to take the property of any individual member of such assemblage, except so far as might be absolutely necessary to carry out and fulfill the purposes for which it was proposed to

call the state into existence. They would be mentally blind if they did not see at once that intrusting to the state a power of unlimited interference with the citizen's right to property, they would create not a free government but a despotism.

The question may be here naturally asked, Is there any record in history of any assemblage of the founders of a state which discussed this subject, or took definite action in respect to it? In answer it may be said that the two most striking assemblages in history which resulted in the formation of states, and of which any record is preserved, occurred in connection with the first settlements of New England, and that which resulted in the formation of the Federal Constitution and the creation of the nationality of the United States. The assertion would hardly be warranted that the early plantations of New England were formal assemblages gathered together for the avowed purpose of forming a state. They were, in fact, land companies, and so far as the law then existing permitted, were incorporated as such. This act of incorporation, derived from a corporation created by James I of England in 1606, and known as the Plymouth Company, was in the first instance and at once used as the basis for forming a political organization by the members of a land company or plantation. The necessity of a revenue to defray the expenses of the organization or incipient government, and in default of which there would be no adequate protection to persons and property, or, what is the same thing, no civilization, was at once recognized; and probably the very first act of the assemblage of the members of the company, after the selection of persons to exercise authority, was to authorize the levy of taxes. These taxes were assessed and collected in all respects as they are now in the great States that have been the outcome of these feeble plantations, through what may be termed a process of political evolution. That is, the individual members of the various communities or their authorized representatives met in their "General Court," as it was called, made appropriations, and, in order to pay them, levied what they termed a "rate" or assessment. This levy was put into the hands of a constable, who proceeded to enforce or collect the tax, either in the form of work or commodities or money. There is furthermore no indication in the records of these early times of any limitation as to the extent or degree of assessment, and for the very obvious reason that it never then occurred to any one that the power of taxation could possibly be used for the destruction of private property or controlling the acquisition and distribution of property—the inventions of a later period. The taxation of those days was necessarily of the crudest possible character. It fell almost exclusively on real property, and what was manifestly tangible and visible, for the very good reason that there was very little of what is now

called personal property in existence—that is, there were no credit or paper representatives of property, but everything in the nature of property existed in the form of land, slaves, houses, animals, agricultural products, tools, or furniture.

The record of the assemblage (convention) that drafted the Constitution, which by adoption by the parties (States) thereto called the United States into existence as a nation, on this subject of guarding and limiting the taxing power on the part of the prospective State or Government which they proposed to create, is comparatively full and complete. The Revolution, which involved the renouncing of all allegiance of the British-American colonies to the mother country, had its origin in unjust taxation; and in the Declaration of Independence this fact was made conspicuous among the reasons that were relied on by the colonies to justify their action in the opinion of mankind. The attempt in 1778 to establish a General Government by the union of all the colonies under certain conditions, known as Articles of Confederation, was found after a few years of experience to be wholly lacking in all the elements of strength and stability, through the lack of any proper adjustment of the power of taxation; thereby entailing an almost complete inefficiency of sovereignty. Thus, there was no power in the Congress of the Confederation to raise money by taxation; but the Confederation depended for revenue upon requisitions on the several States, with which the States might comply or not, as they chose, and with which they generally did choose not to comply, either promptly or fully, if at all. Some of the States levied duties on the imports of merchandise at the expense of their neighbors; and adjacent ports in different States competed with each other by arbitrarily varying the rates on imports, as the Congress of the Confederation had no authority to regulate commerce, or legislate on this subject for the whole country.* The result was, as Mr. Madison expressed it, that "the Federal authority had ceased to be respected abroad, while at home it had lost all confidence and credit." It was to remedy this one radical infirmity, more than any other, that the present Constitution was projected and formed. Other great improvements in the Articles of Confederation were contemplated and made in the Constitution when it was formed, but the most important of all was in the regulation of taxation. Hamilton, who drafted the address to the States inviting them to send dele-

* The author of The Federalist (No. 7) refers to the situation of New York, as compared with that of Connecticut and New Jersey, as affording an example of the opportunities which some States had under the Confederation of rendering others tributary by a monopoly of the taxes on imports, and said that New York would neither be willing nor able to forego the advantage of levying duties on importations, a large part of which must be necessarily paid by the individuals of the other two States in their capacity of consumers.

gates to the convention by which it was formed, wrote thus in The Federalist:

"The power of taxation is the most important of the authorities proposed to be conferred on the Union."

The necessity of conferring adequate power in this particular upon the new Government which it was proposed to create was admitted by all; and yet there was no power which the people were more determined to guard, so that it could never be arbitrarily or unjustly exercised. And if it had not been supposed that the provisions of the new Constitution furnished ample security against any such action, not one of the States would have assented to its ratification.

The preamble of the Constitution asserts, almost in the first instance, that the object of its formation was to "establish justice," an obvious correlative of which is that there must be equality, and no discrimination in taxation as respects the same persons or things. In its first article (second section) it next provided that "representatives (in Congress) and direct taxes shall be apportioned among the several States according to their respective numbers, excluding Indians not taxed." The explanation of this provision, which now seems singular, is undoubtedly to be found in the assumption of the framers of the Constitution that taxation in the future, as it had been in the past, would be mainly *direct* in its assessment and incidence; and that wealth was so equitably distributed in the colonies (as it was at that time), and, as Roger Sherman, of Connecticut, expressed it, "the number of people alone" was "the best rate of measuring wealth." And on such supposition the absolute requirement of a strict apportionment of taxation according to population, with an inherent penalty of loss in congressional representation as the result of evasion, was undoubtedly regarded as a safeguard against unjust or discriminating taxation.

Next, in section 8, article 1, after empowering Congress "to lay and collect taxes, duties, imposts, and excises," to pay the debts and provide for the common defense and general welfare of the United States, was added another provision, the like of which does not find an exact counterpart in any political constitution or statute of which there is historical record—namely, that "all duties, imposts, and excises shall be uniform throughout the United States." This provision is one of the first importance. It would seem that there could be no doubt that the framers of the Constitution, having specially in view the fact that, under the Articles of Confederation, the several States endeavored to tax everything belonging to every other State that came within their territorial jurisdiction, and that there was no authority on the part of the then General Government to prevent such action, did not mean

that the entity, called a State, they were about to create, should have any power of discriminating in respect to the imposition of duties, imposts, and excises in any degree; fully recognizing that the moment a State or government thus discriminates it passes the line of distinction between a free government and one that is not free. It is to be further noted that the words "to pay the debts and provide for the common defense and general welfare of the United States" should also be regarded in the light of a limitation of the purpose for which the taxes, etc. (authorized in the opening words of the section), may be laid and collected. This view was taken and strongly presented by Mr. Jefferson in 1791, shortly after the adoption of the Constitution. He says: "To lay taxes to provide for the general welfare of the United States is to lay taxes for the purpose of providing for the general welfare. For the laying of taxes is the *power*, and the general welfare the *purpose*, for which the power is to be exercised. They are not to lay taxes *ad libitum for any purpose they please*, but only *to pay the debts or provide for the welfare of the Union.* In like manner they are not *to do anything they please* to provide for the general welfare, but are to *lay taxes for that purpose.*"—*T. Jefferson's Works, p. 557.*

Finally, there was added by amendment to the Constitution the following provision, which, although implied in the *Magna Charta*, had not been previously so explicitly expressed in the Constitution or statutes of any other State: "*Nor shall private property be taken for public use without just compensation.*" Obviously this provision constitutes another limitation on the power of Congress in respect to the taking of private property for public use by taxation or any other method. In a case involving the bearings of this provision on the taxation of a citizen of New Jersey, the Supreme Court of that State analyzed and interpreted its meaning as follows: "A tax upon the person or property of A, B, and C individually, whether designated by name or in any other way, which is in excess of an equal apportionment among the persons or property of the class of persons or kind of property subject to this taxation is, to the extent of such excess, the taking of private property for a public use without compensation. The process is one of confiscation and not of taxation."—*36 New Jersey, p. 66, 1872.*

It is certain, therefore, that in at least one assemblage for the purpose of creating a State—namely, the Federal Convention—its members clearly recognized the incompatibility of the possession and exercise of an unlimited power of taxation by a State and the coexistence of a free government.

RIGHT OF EMINENT DOMAIN.—Apart from the right of a State to take private property for its use by taxation, the State

may also legitimately take such property when the interest of the public requires it, through what is called the *law or right of eminent domain*. The distinction between the power of taxation and the power of eminent domain is, however, clear and well defined. An appropriation of property under the right of eminent domain is a forced sale which its owner is compelled to make for the public good, and for which a pecuniary consideration equal to the estimated full value of what is taken is due from the State. And the exaction can not be considered as a tax "unless similar contributions are made by the public itself, or be exacted rather by the public will, from such constituent members of the same community as own the same kind of property." On the other hand, no pecuniary consideration is paid when money is demanded under the power of taxation, the benefits which the taxpayer is assumed to receive being indirect.

AN IMPORTANT IMPERFECTION OR OMISSION IN THE FEDERAL CONSTITUTION.—Any discussion of the sphere of taxation in the United States would be incomplete that failed to recognize a feature, in the way of imperfection or serious omission, in the Federal Constitution, that hitherto has not attracted the attention it deserves. All powers inherent in the Constitution of the United States were derived from the States, and granted by them in their acts of ratification; and "the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively or to the people."—*Article X, Constitutional Amendments.*

As has been already pointed out, the convention that framed the Constitution was especially solicitous and careful to guard and limit the power of taxation on the part of the new Government which it was proposed to create, so that it could never be arbitrarily or unjustly exercised. They anticipated in action the aphorism of John Stuart Mill, that "men do not need political rights in order that they may govern, but in order that they may not be misgoverned"; for, as was truly said by Guizot, "a constitution is only a device for turning ordinary mortals into tolerable monarchs." At the same time, the convention practically omitted to impose any limit or restriction on the exercise of the power of appropriating private property on the part of the States; or, as Chancellor Kent expressed it in his Commentaries on the Constitution, they left "to a State the command of all its resources and the unimpaired power of taxing the people and property of the State." On this point the only direct provisions of the Constitution are that neither the Federal nor State governments shall take private property for public uses—i. e., by taxation or right of eminent domain—without due compensation; and that no State, without the consent of Congress, shall lay any im-

posts or duties on imports or exports. By repeated decisions of the United States Supreme Court, another provision has been substantially ingrafted in the Constitution—to wit, that neither the Federal Government nor the governments of the States shall tax any of the instrumentalities or exclusive property of the other. The result is that, except for possible provisions in the Constitutions of the several States, their respective legislative assemblies may regulate, restrict, or appropriate the property of its citizens to an unlimited extent, and may delegate this sovereign power to local municipal corporations created by them. In short, in virtue of the power of levying unlimited taxes, the power of the Legislatures of the States that make up the Federal Union is as absolute as that of the Czar of Russia or the Sultan of Turkey. Not only may they take in this form all the property in the commonwealth, but also the property of its citizens in other countries. There is no Federal constitutional hindrance to their taxing, to any amount, real estate in any other State or country owned by citizens resident within their territorial jurisdiction. The constitutional provision that private property must be paid for when taken for public uses mainly refers, in the States, to the taking of land for highways and other similar acts of necessity by eminent domain.*

How little the people of the United States recognize the fact that they are living under a dual form of government, with like powers to some extent, especially in respect to the exercise of taxation, finds an illustration in the following incident. The question was recently put to the writer by a gentleman who had filled with ability the office of Governor of one of the leading States of the Federal Union, how it happened that the Federal

---

* "There is nothing in the Constitution of the State of New York which requires that taxation shall be general, so as to embrace all taxable persons in the State, or within any district of the State; or that it shall be equal, or that it shall be in proportion to the value of the property of the person taxed, or that it shall not be apportioned according to the benefit which each taxpayer is supposed to receive from the object on which the tax is expended."—*People ex rel. Griffin vs. Mayer, 4 N. Y., 419, 1851.*

"There is no constitutional limitation upon the legislative power to tax the persons and property of individuals within the State. The power may be exercised to pay debts contracted before the property-holder comes within the jurisdiction."—*Pampelly vs. Village of Oswego, Ct. of App., 1863, N. Y.*

"Unless restrained by provisions of the Federal Constitution, the power of the State as to the mode, form, and extent of taxation is unlimited when the subjects to which it applies are within her jurisdiction."—*Kirtland vs. Hotchkiss, Connecticut.*

"The Legislature can constitutionally impose a tax on all watches, pianos, carriages, dogs, spirituous liquors, or other chattels without reference to their value. It can impose an arbitrary tax upon any avocation or business without estimating its volume or value."—*People vs. Equitable Trust Co. of New London, Conn., 1887; System of Taxation in the State of New York, prepared by Hon. Julien T. Davis, at request of a committee of the Legislature, 1888.*

Government could impose on him an income tax, and his own State, at the same time, assess him with not only another like income tax, but also with a tax on the property from which his income was derived? The idea of a dual government and its inconveniences, and that the Congress of the Federal Government had not cared to remedy the latter, had not occurred to the interrogator.

Had the power of the States to take money by taxation from their people been limited at the time of the formation of the Federal Union by constitutional provisions, the injury and disgrace of State repudiation might have been wholly avoided, and much wasteful extravagance checked.

"Within an hour's ride from the city of New York several towns can be reached that were bankrupted by undertaking 'public works upon a magnificent scale.' The number of Western communities that have been ruined from the same cause is countless. A very great number of people in the Eastern States, both poor and of the middle class, have been impoverished by the sudden check to the prosperity of these communities. Nor is any severer tax imposed upon any class than that which is paid by those who have only their wages to live upon, when they are deprived of these by the collapse of municipal credit and the consequent sudden stop to extravagant expenditure. The average cost of the pensions paid by the United States is ten to twelve dollars a year to every family in the country, and in many cases the pension charge alone is equal to half a month's or even to a month's wages. Not a few of the governments of the earth are now insolvent because of excessive expenditures upon public works. In South America and Australia, extravagant undertakings of this kind have caused widespread ruin and distress; and the poor of several other nations are likely to find out eventually that the alleviation of temporary distress by governmental expenditure of capital is like keeping off the cold by burning down the house." —*D. MacG. Means, The Forum, 1894.*

That the State governments should have bestowed the unlimited and imperial power of taxation upon city governments, and given up to their use and control the entire property of the citizens, is an extraordinary abuse of trust and a renunciation of the true functions of government. As a result of this policy these delegated governments have, within a comparatively recent period, absorbed for alleged public uses a large proportion of the property of the citizens, to the estimated extent in some instances of more than one third—that is, the usufruct (right of using and enjoying)—and the American citizen has to-day no constitutional or legal remedy. "No such plunder was ever sanctioned or practiced before in the history of civilized governments. That it has

been possible in the United States argues the gravest defect in its political system. That a check is needed of the most absolute kind is recognized by all thoughtful men. Such check can only be had from the Legislatures of the States, who can not be too prompt in correcting the evils resulting from this extraordinary surrender of their supreme jurisdiction on the vital subject of taxation. The Legislature holds the public purse, and is false to its trust as its custodian when it authorizes corporations to put their hands, unwatched, into this purse and take from it, uncounted, all that their extravagance and cupidity desire. It is no apology that city governments are chosen by popular vote. It is the essence of our government that personal rights are, by our Constitution, wholly independent of the voting power, and certainly property should be equally so protected."

The question here naturally arises, How happened it that the framers of the Constitution and founders of our Government, while carefully defining and limiting the powers of the Federal Government in respect to the taking of property through taxation, omitted to make any like provisions applicable to the States? An answer is, that it was probably an oversight, favored by the circumstance that there was no English precedent for suchp rovisions. At the time of the Revolution it was, and ever since has been, the occupation and duty of the British House of Commons to limit and, if considered expedient, resist the pecuniary demands of the crown, and latterly of its ministers; and this occupation and duty were never delegated without restriction to any subordinate legislative assemblage. It might have been, and probably was, assumed by the framers of the Federal Constitution, that the several States in making their Constitutions would have followed the precedents respecting the rights and duties of taxation that they (the framers) had established; and, if the several Legislatures of the States had been confined to these rights and duties, and had never delegated them without restriction to the complicated, ill-organized, and irresponsible municipal corporations, which in latter days have grown to such portentous size, little of danger would have followed.* It should, however, be here noted that remedial action in this matter has recently been taken by some of the States, by forbidding their counties, cities, towns, or villages from incurring an indebtedness in excess of a percentage, varying with their population, of the valuation of the real estate subject to taxation. Constitutional restrictions on

* In his treatment of this important topic, the author is mainly indebted to Mr. Manley Howe, of Boston, who, in a newspaper article published some years ago, seems to have been the first person to intelligently present the facts in the case and their consequences to the general public.

the borrowing power of the State itself, and of the municipalities within its territorial jurisdiction, have also in some of the States been adopted.

From the above discussion the following conclusions would seem to be fully warranted:

The limitation on the exercise of the power of taxation under a free government necessarily grows out of the source and sole justification of the power—namely, its *necessity;* and the righteousness of any specific interference by the state with individual rights in respect to property (as well as in respect to personal liberty) may be tested by the question, *Is it necessary?* Not Is it convenient? Not Is it suitable? If the necessity exists, then the power may be justifiably exercised to a corresponding extent. But, on the other hand, if the interference transcends that which is absolutely essential for fulfilling the rightful purposes for which the state exists, then it loses its sole justification of necessity and becomes tyranny, the definition of which is "despotic use of power." Further, "if the state, even to promote its necessary and legitimate objects, takes the amount of property to which it is entitled in such a manner as requires a citizen to pay more than his just share of the requisite amount—whether it be great or small—it takes that to which it has no right; it does what, if done by a citizen in defiance of law, is called robbery; if under color of law, is called fraud; but which in a government which makes law is simply confiscation and tyranny." And yet, very strangely, this tyranny has come to be regarded and defended by not a few intelligent persons who claim to understand the theory and nature of a free and just government as an act of wisdom and statesmanship, and in the highest degree beneficent to the citizen whose property is confiscated.

REPORTING concerning the progress made on the English Philological Society's New English Dictionary, now in F, Mr. H. Bradley observed that the F-words include many scientific terms, and some of the oldest English and Romanic words, besides several onomatopœic words of arbitrary coinage. Initial *fl* has attracted makers of imitative and contemptuous words: *flip, flap, flop; flish, flash, flush; flick, flack, fluck; flim-flam, flip-flap,* etc. Of special words, *foist* has not the nauseous origin often attributed to it, but is analogous to the dialectical German *fäusten*, to get into one's fist. It occurs first in Dice-Play, of 1532, and means the holding in hand of a false die, to introduce at any point of the game; the false die was "foisted in"; all the known senses flow from this and parallel those of *cog. Fogger* in "pettifogger of the law," of about 1550, and in trade a huckster, peddler, sweater, is probably from the Fuggers, the great merchants of Antwerp in the fifteenth century. The word has passed into many languages. To *fog*, to cheat, swindle, is a back formation from *fogger.*

THE RELATIONS OF BIOLOGY, PSYCHOLOGY, AND SOCIOLGY.

By HERBERT SPENCER.

FROM time to time proof has come to me that in the United States there have arisen erroneous conceptions of my views concerning the connections between the sciences dealing respectively with organic evolution and super-organic evolution. These misconceptions will, if nothing be said, become established. Hence it seems needful that I should point out how entirely at variance with the evidence they are. The following extracts from two leading American writers on Sociology will sufficiently exemplify them. Mr. Lester Ward says:—

"The founder of sociology placed it next above biology in the scale of diminishing generality and increasing complexity, and maintained that it had that science as its natural basis and as the substratum into which its roots penetrated. Herbert Spencer, although he treated psychology as a distinct science, and placed it between biology and sociology in his system of Synthetic Philosophy, made no attempt to affiliate sociology upon psychology, while on the contrary he did exert himself to demonstrate that it has exceedingly close natural affinities with biology, as was shown in the third paper. At the close of that paper the fact came clearly forth that almost the only legitimate comparisons between society and a living organism were those in which the nervous system was taken as the term of comparison. In other words, it was clear even then that the class of attributes in the individual animal with which those of society could best be compared were its psychic attributes. If we are to have a science of psychology distinct from biology these attributes belong to that science, and hence it is really psychology and not biology upon which sociology directly rests." ("Sociology and Psychology." In *American Journal of Sociology*, vol. i, No. 5, March, 1896.)

In his recent work, published under the same title as my own, *The Principles of Sociology*, Prof. Giddings recognizes the fact that by me "the principles of sociology are derived from principles of psychology and of biology" (p. 8). But by his expressed belief that "the time has come when its principles, accurately formulated and adequately verified, can be organized into a coherent theory" (p. 17), he tacitly implies that my own theory is not coherent; and he proceeds to supply that which he regards as the needful bond—an ultimate psychological bond. His words are:—

"Accordingly, the sociological postulate can be no other than this, namely: The original and elementary subjective fact in society is *the consciousness of kind*. By this term I mean a state of consciousness in which any being, whether low or high in the scale of life, recognizes another conscious being as of like kind with itself." (*Ib.*)

And then on p. 19, after indicating the external conditions which prompt social aggregations, he goes on to say:—

"But presently, within the aggregation, a consciousness of kind appears in like individuals and develops into association. Association, in its turn, begins to react favorably on the pleasures and on the life chances of individuals."

To deal properly with the several questions thus raised I must go back to the beginning. In my first work, *Social Statics*, published in 1850, will be found evidence that at the very outset I regarded the Science of Society as having for its chief datum the Science of Mind. This was not overtly asserted, for at that time questions concerning the filiation of the sciences were not entertained by me; but it was taken for granted as an obvious truth. All through the work there runs the implication that societies are determined in their actions and structures by the mental characters of their units; and in a closing chapter, entitled "General Considerations," there is a delineation of the way in which, along with mental evolution in men, there goes higher social evolution. Here are some extracts indicating this:—

"So that only by giving us some utterly different mental constitution could the process of civilization have been altered."

"Dependent as they are upon popular character, established political systems can not die out until the feeling which upholds them dies out."

"So that wild races deficient in the allegiance-producing sentiment can not enter into a civilized state at all; but have to be supplanted by others that can."

"Of course the institutions of any given age exhibit the compromise made by these contending moral forces at the signing of their last truce."

"The process by which a change of political arrangements is effected, when the incongruity between them and the popular character becomes sufficient, must be itself in keeping with that character, and must be violent or peaceful accordingly."

That these conceptions remained unchanged in 1860, when the prospectus of the Synthetic Philosophy was issued, might be inferred even from the order of the subjects specified in it, which ran:—*Principles of Biology, Principles of Psychology, Principles of Sociology.* But this prospectus contains much more definite evidence of my persistent belief in the dependence of Sociology upon Psychology. Of the divisions constituting the *Principles of Psychology* the last stands thus:—"VIII. Corollaries.—Consisting in part of a number of derivative principles which form a necessary introduction to sociology." And then in pursuance of the thought there expressed, the enumeration of the divisions constituting the *Principles of Sociology* begins thus:—"Part I. The Data of Sociology.—A statement of the several sets of factors entering into social phenomena—human ideas and feelings considered in their necessary order of evolution; surrounding natural conditions; and those ever complicating conditions to which society itself gives origin:" in which statement of data, be it ob-

served, there is no mention of biological data. Even without saying more, I should, I think, have furnished adequate disproof of the erroneous assertions quoted above. But now let me pass on from the programme of these works to the works themselves. The closing division of *The Principles of Psychology*, entitled "Corollaries" (as in the programme), opens with a chapter containing the following passages:—

"Having presently to follow out Evolution under those higher forms which societies present, the special psychology of Man, considered as the unit of which societies are composed, must be briefly outlined." . . .

"It is manifest that the ability of men to co-operate in any degree as members of a society, pre-supposes certain intellectual faculties and certain emotions. . . . Hence, in preparation for the study of social evolution, there have to be dealt with various questions respecting the faculties it brings into play, and respecting the modes in which these are developed during continued social life." (§ 477.)

In pursuance of this announcement, there presently follows a chapter on "Language of the Emotions," which introduces a chapter entitled "Sociality and Sympathy." The manifest implication is that recognition of these mental factors must precede the interpretation of social phenomena. After indicating, as Prof. Giddings has recently done, the genesis of sociality, which in certain classes of animals becomes "naturally established as furthering the preservation of the species," I have gone on to say:—

"Sociality having thus commenced, and survival of the fittest tending ever to maintain and increase it, it will be further strengthened by the inherited effects of habit. *The perception of kindred beings, perpetually seen, heard, and smelt, will come to form a predominant part of consciousness*—so predominant a part that absence of it will inevitably cause discomfort." (§ 504.)

Here, it seems to me, there is described in other words, that "consciousness of kind" which Prof. Giddings regards as the "new datum which has been sought for hitherto without success" (p. 17); and that it is regarded by me as the primary datum is shown by a subsequent sentence running as follows:—

"Among creatures led step by step into gregariousness, there will little by little be established a pleasure in being together—a pleasure in the consciousness of one another's presence—a pleasure simpler than, and quite distinct from, those higher ones which it makes possible."

After proceeding, through a dozen pages, to trace the development of sympathy as a result of gregariousness, there comes a brief statement of—

"The cardinal facts which it has been the aim of this chapter to bring to view, and which we must carry with us as aids to the interpretation of emotional development, and to the subsequent interpretation of the sociological phenomena accompanying emotional development." (§ 512.)

And then in a subsequent chapter on "Altruistic Sentiments"—sentiments all having their roots in sympathy—there is a delineation of the ways in which these stand related to social evolution.

We come now to a still larger mass of evidence directly disproving the statement that I have "made no attempt to affiliate sociology upon psychology." On passing to the *Principles of Sociology* itself I have, in setting forth its data, dealt elaborately with certain further psychological dependencies. After preliminary chapters come three entitled respectively "The Primitive Man—Physical," "The Primitive Man—Emotional," and "The Primitive Man—Intellectual": a fact which implies full recognition of the psychological factors. But this is far from being all. There follows a chapter which begins with the sentence:—"Yet a further preparation for interpreting social phenomena is needful;" and the preparation thereupon commenced is an account of "Primitive Ideas." After 30 pages describing the genesis of these, come seventeen chapters setting forth the resulting development of ancestor-worship and the accompanying superstitions. More than 300 pages are thus occupied; avowedly because the conduct of men in society can not be understood until the natures of these primitive beliefs and accompanying emotions are understood. Sentences from the succeeding chapter on "The Scope of Sociology" run:—

> "And now observe the general conclusion reached. It is that while the conduct of the primitive man is in part determined by the feelings with which he regards men around him; it is in part determined by the feelings with which he regards men who have passed away. From these two sets of feelings, result two all-important sets of social factors. While *the fear of the living* becomes the root of the political control, *the fear of the dead* becomes the root of religious control." (§ 209.)

In pursuance of these general conclusions there are given in subsequent parts of the work various illustrations of the ways in which these psychological factors conduce to social evolution—as in the chapter on "Political Heads" (§§ 477, 482); as in the chapter on "Laws" (§§ 529, 535); as in the whole division on "Ecclesiastical Institutions"; and in many less conspicuous places.

How has it been possible for these misconceptions to have arisen? is a question that necessarily suggests itself. Among causes to be considered is the occurrence of two chapters in *The Study of Sociology* entitled respectively "Preparation in Biology" and "Preparation in Psychology." In the first of these, along with avowed dissent from certain of M. Comte's sociological views, there goes applause of him for having "set forth with comparative definiteness the connection between the science of life and the science of society"; and again, concerning his general conception, it is said that "among other of its superiorities

was this recognition of the dependence of sociology upon biology." Moreover a subsequent sentence runs thus:—

"In the first place, all social actions being determined by the actions of individuals, and all actions of individuals being vital actions that conform to the laws of life at large, rational interpretation of social actions implies knowledge of the laws of life."

But though these passages seem to support the interpretation of my views which I repudiate, yet on looking at the context it will be seen that this is not so. For, as shown by preceding and succeeding passages, "the laws of life at large," as here understood, are laws comprehensive of both bodily life and mental life. Though, as I have conspicuously shown, I do not, like M. Comte, merge psychology in biology—though, under its objective aspect, I regard it as a science clearly marked off, and under its subjective aspect as a science fundamentally contrasted with all others; yet, as every one must do, I admit that the science of mind is dependent on the science of life. For we know nothing whatever of mind save as exhibited by living bodies. That by "laws of life at large" I mean laws of bodily life and mental life taken together, is, indeed, clearly implied by the use of the words "the actions of individuals," as being dependent on these laws of life; since the actions of individuals are all mentally determined. But there are set forth in the chapter named, certain direct dependencies of social phenomena on vital phenomena. It is said that the sociologist must learn "the laws of modification to which organized beings in general conform"; that he must recognize the effects of use and disuse in causing increase and decrease of bodily and mental powers; that he must remember how, as a consequence, human nature "is always adapting itself both directly and indirectly to its conditions of existence"; and that he must bear in mind the truth that "every species of creature goes on multiplying till it reaches the limit at which its mortality from all causes balances its fertility," so that taking away one cause of mortality by and by entails intensification of other causes arising from increased pressure of population. Against this evidence, however, has to be set the evidence contained in the next chapter, which shows the still more important dependencies of sociology upon psychology, and ends with the conclusion that "without preparation in mental science there can be no social science."

But the small regard paid to all the proofs given at the outset that the psychic factors of social phenomena are by me considered the predominant ones, appears to have resulted from thinking only of the parallelism I have asserted between certain traits of individual organisms and certain traits of social organisms. Prof. Giddings writes:—

"The second form in which the characteristic error of sociological classifications appears is that of the overworked biological analogy. Mr. Spencer's essay on 'The Social Organism' made a lasting impression. At present the greater part of sociological literature is written in terms of a biological nomenclature. . . . Sociology will have to discard this classification and nomenclature. . . . In certain fundamental things social organization is like vital organization, but in all that justifies Mr. Spencer's own phrase of 'super-organic evolution' it is peculiar, and not to be classed with organisms. Were this not true, sociology would be a mere division of biology." (Pp. 62–63.)

Most readers will, I think, carry away from these sentences the impression that I am supposed to have dwelt too much on this analogy in my sociological interpretations. But any one who reads through *The Principles of Sociology*, or even reads the titles of its chapters, will see that this analogy plays but a relatively inconspicuous part. I must be excused if, to make clear the way in which I conceive and use the analogy, I go back to the origin of it. In a chapter of *Social Statics* entitled "General Considerations" (pp. 451–3 in the edition of 1850) occur the following passages:—

"Hence we are warranted in considering the body as a commonwealth of nomads, each of which has independent powers of life, growth, and reproduction; each of which unites with a number of others to perform some function needful for supporting itself and all the rest; and each of which absorbs its share of nutriment from the blood. And when thus regarded, the analogy between an individual being and a human society, in which each man, while helping to subserve some public, want absorbs a portion of the circulating stock of commodities brought to his door, is palpable enough.

"A still more remarkable fulfillment of this analogy is to be found in the fact, that the different kinds of organization which society takes on, in progressing from its lowest to its highest phase of development, are essentially similar to the different kinds of animal organization. Creatures of inferior type are little more than aggregations of numerous like parts—are molded on what Prof. Owen terms the principle of vegetative repetition; and in tracing the forms assumed by successive grades above these, we find a gradual diminution in the number of like parts, and a multiplication of unlike ones. In the one extreme there are but few functions, and many similar agents to each function: in the other, there are many functions, and few similar agents to each function. . . .

"Now just this same coalescence of like parts, and separation of unlike ones—just this same increasing subdivision of functions—takes place in the development of society. The earliest social organisms consist almost wholly of repetitions of one element. Every man is a warrior, hunter, fisherman, builder, agriculturist, toolmaker. Each portion of the community performs the same duties with every other portion; much as each portion of the polyp's body is alike stomach, skin, and lungs. Even the chiefs, in whom a tendency toward separateness of function first appears, still retain their similarity to the rest in economic respects. The next stage is distin-

guished by a segregation of these social units into a few distinct classes. . . . And without further illustration the reader will at once perceive, that from these inferior types of society up to our own complicated and more perfect one, the progress has ever been of the same nature."

In pursuance of the analogy it is then shown that in either case in proportion to the multiplication of unlike parts, severally taking unlike functions, there is "an increasing mutual dependence" and a consequent individuation (integration) of the whole organism, animal or social: * the mutual dependence of parts being represented as that which constitutes the aggregate an organism.

Ten years later, in the essay on "The Social Organism," the conception here briefly outlined was elaborated. Four analogies between living bodies and bodies politic were enumerated.

"Commencing as small aggregations, they insensibly augment in mass. . . . While at first so simple in structure as to be considered structureless, they assume, in the course of their growth, a continually-increasing complexity of structure. . . . Though in their early, undeveloped states, there exists in them scarcely any mutual dependence of parts, their parts gradually acquire a mutual dependence. . . . The life of a society is independent of, and far more prolonged than, the lives of any of its component units." (*Essays*, Library ed., vol. i, p. 272.)

Neither in *Social Statics*, nor, I believe, in this essay is there any assertion that this analogy between animal structures and social structures is to be taken as the basis for sociological interpretations. In what way the analogy has been regarded by me was shown at a later date in *The Study of Sociology*. In that work it is said:—

"Now if there exists this fundamental kinship, there can be no rational apprehension of the truths of Sociology until there has been reached a rational apprehension of the truths of Biology." (P. 334.)

Taken by itself this sentence appears to justify the interpretation given of my view, but the sentences immediately succeeding show that this is not so.

"The services of the two sciences are, indeed, reciprocal. We have but to glance back at its progress, to see that Biology owes the cardinal idea on which we have been dwelling, to Sociology; and that having derived from Sociology this explanation of development, it gives it back to Sociology greatly increased in definiteness, enriched by countless illustrations, and fit for extension in new directions."

In pursuance of this assertion it is pointed out that Milne-Edwards derived "the conception of 'the physiological division of labor'" from the generalizations of political-economists. It is then said that "when carried from Sociology to Biology, this conception

* In passing I may remark that in the alleged progress from uniformity to multiformity, as well as in the implied processes of differentiation and integration, may be seen the earliest germ of the thought which eventually developed into the formula of evolution at large.

was forthwith greatly expanded"; and further on it is said "that the truth thus found to be all-embracing in Biology returns to Sociology ready to be for it, too, an all-embracing truth." Here it is manifest that the two sciences are regarded as yielding mutual elucidations; and if, as the first sentence taken alone may appear to imply, I regard the analogy as showing that Sociology must be based on Biology, then, on the strength of the subsequent sentences, it may just as truly be said that I base Biology upon Sociology. Clearly, when taken together, these passages show the thought to be that for distinct understanding of either science certain conceptions furnished by the other must be possessed. It can not be said that each science is based on the other. Hence the alleged connection must be not a necessary dependence but an exchange of enlightenments. There is direct proof of this. The sociological division of labor had been recognized long before Biology had assumed a scientific form; and "the physiological division of labor," though not thus named, had been long recognized in living bodies as a co-operation among the various organs. In either science the conception might gradually have been elaborated to the full without aid from the other, though with nothing like the same rapidity and clearness.

Let us pass finally to the exposition of the analogy contained in Part II of *The Principles of Sociology*. It is there said that "between a society and anything else, the only conceivable resemblance must be one due to *parallelism of principle in the arrangement of components.*" (§ 213.) It is shown "how the combined actions of mutually-dependent parts constitute life of the whole, and how there hence results a parallelism between social life and animal life." (§ 218.) Mutual dependence of parts being thus regarded as the essential trait in either case, there is subsequently pointed out a fundamental contrast between the modes in which this mutual dependence is effected in individual bodies and in bodies politic. § 221 begins—

> "Though coherence among its parts is a prerequisite to that co-operation by which the life of an individual organism is carried on; and though the members of a social organism, not forming a concrete whole, can not maintain co-operation by means of physical influences directly propagated from part to part; yet they can and do maintain co-operation by another agency. Not in contact, they nevertheless affect one another through intervening spaces, both by emotional language and by the language, oral and written, of the intellect."

It is argued that mutual dependence of parts requires the conveyance of impulses from part to part, and that while "this requisite is fulfilled in living bodies by molecular waves," "it is fulfilled in societies by the signs of feelings and thoughts, conveyed from person to person."

Here, then, we come to a proof, more conclusive even than that before given, that social actions are regarded by me as resulting from mental factors. Though the specialization of functions, or division of labor, is held to be analogous in living bodies and social bodies—though, in both cases, co-operation of the mutually-dependent parts has to be effected by stimuli conveyed from one to another; yet it is shown that while in the one case this prerequisite is effected by a physical process, it is in the other case effected by a psychical process. So that beyond the proofs variously given that the organization of each society is mainly caused by the mental traits of its units, there is here given the proof that these mental traits produce their results through certain mental products—the signs of feelings and thoughts.

And now let me add a not unimportant conclusion brought into view by this long explanation. In the course of it there has become manifest to me the essential distinction, which I had not before observed, between the dependencies of Sociology on Biology and the dependencies of Sociology on Psychology. They concern respectively the substance of society and the structure of society. We may contemplate the social aggregate simply as a mass of living units, ignoring any arrangement of its parts; or, tacitly positing the existence of the mass, we may occupy ourselves exclusively with the arrangement of its parts. Under the one head we are concerned only with changes of quantity and quality—increases or decreases of the units in number, and organic modifications of their natures: changes produced in the course of generations by subjection of the units to certain conditions of life. For interpreting social phenomena included in this group, we depend directly upon Biology. Under the other head we are concerned only with the development of this social aggregate into an organization of mutually-dependent parts performing different duties—the gradual evolution of structures and correlative functions and formation of a more and more integrated whole. For interpreting the phenomena included in this far more conspicuous and important group, we depend directly upon Psychology. Though the two can not be sharply separated, since bodily life and mental life are indissolubly united, and exert reciprocal influences, yet, as being respectively concerned with social substance and social form, the two are sufficiently contrasted.

THE editors of the Zoölogical Record count 366,000 distinct species in the animal world, of which 230,000 are insects and only 2,500 are mammals. Next most numerous to the insects are the mollusks, 50,000 species; crustaceans, 20,000; birds, 12,500; fishes, 12,000; and arachnids, or the spider family, 10,000 species.

BOTANIC GARDENS.

By D. T. MACDOUGAL,
ASSISTANT PROFESSOR OF BOTANY IN THE STATE UNIVERSITY OF MINNESOTA.

I.—ORIGIN AND GENERAL ORGANIZATION.

THE term *botanic garden* is used to designate a limited area of ground on which is grown a collection of plants of a large number of species, arranged in a manner that will subserve some educational, æsthetic, scientific, or economic purpose. At the present time the utilitarian feature embraces the chief design of but few gardens, yet it is to the economic purpose that these institutions owe their origin. It will be interesting in this connection to note the successive changes of organization by which these institutions, at first as directly practical as possible, have come to subserve the most complex and highly scientific uses.

After the discovery of the medical properties of plants, it must have followed, in course of time, that representatives of the species to which remedial properties were attributed should be collected and grown in some place conveniently and readily accessible as need demanded. The last step did not immediately follow, however, since, among the conditions which were earlier supposed to influence the potency of medicinal herbs, the locality in which grown and the mysteries attending their collection were of the greatest importance. The first authentic record of the introduction of medicinal plants into cultivated plots of ground dates no further back than the time of the elder Pliny (23–79 A. D.), who writes of the garden of Antonius Castor, at Rome, in which were grown a large number of medicinal plants. This step may have been taken much earlier by the Greeks, Chinese, or Mexicans, however. Later the Benedictine monks of northern Italy paid great attention to the growing of remedial herbs, and devoted an important proportion of the monastery gardens to this purpose. This practice was also carried beyond the Alps, and in 1020 a garden was in existence at the monastery of St. Gall, in Switzerland, a few kilometres distant from Lake Constance, which contained sixteen plots occupied by medicinal plants. A garden of this character was founded in 1309, at Salerno, and another in Venice in 1330. In 1309 the Benedictine monks founded an academy called "Civitas Hippocratica" at Monte Cassino, in Campania, which appears to the writer to be among the earliest, if not the first, school of medicine, and established in connection with it a "physics garden." Two centuries later, courses of lectures on the "simples," as the unmixed preparations of herbs were termed, were given in the greater number of Italian universities, under

the title of "lectura simplicium," by the professors of anatomy and surgery. It is interesting to note that the laboratory method of handling the course in "cognitio simplicium" was not introduced until the establishment of the botanic garden at the University of Padua, when, in addition to the lectures, exercises in the demonstration of remedial plants growing in the garden were given under the title of "ostencio simplicium."

The sixteenth and seventeenth centuries witnessed the foundation of many gardens in England, France, Germany, Holland, and Sweden, some of which have had a continuous existence to this day. The garden of Bologna was founded in 1568; Leyden, 1577; Leipsic, 1579; Montpellier, 1596; and Paris in 1597. The last

VIEW OF THE LABORATORY IN THE OXFORD BOTANIC GARDEN. After a photograph.

named was organized for the purpose of determination of "what variations were possible in the style of bouquets worn at the royal courts." Then followed the establishment of the gardens at Giessen in 1605, Strasburg in 1620, Jena in 1629, Oxford in 1632, Upsala in 1667, and Chelsea in 1680.

The Oxford garden is the oldest in England, and a curious feature in its organization is that during its entire term of existence—two hundred and sixty-four years—it has occupied leased ground. It owes its existence to the munificence of the Earl of Danby, who, besides making such alterations in the surface as to secure it from overflow, erected the wall that still incloses it, at a cost of five thousand pounds. The portion of the garden

shown in the view of the Botanical Laboratory exhibits the formal style of planting which prevailed in earlier times.

The Chelsea garden is situated near the Thames, about two miles south from Hyde Park. It was formed by the Apothecaries' Guild of London, for the growth of plants for commercial purposes. Later it was converted to its present use, that of furnishing material to illustrate lectures in pharmacy and medicine. Surrounded on all sides by brick buildings, and shaded by smoke and fog, the rectangular plots of officinal plants exhibit very strikingly the deleterious effects of an atmosphere laden with acids. The would-be visitor to this quaint old place must arm himself with an admission card obtained from the Apothecaries' Society, and from the creaking formalities attendant upon the granting of such permission by unaccustomed but polite officials it may be inferred that the casual sight-seer does not often find his way into the place.

During the period inclusive of the foundation of the last-named institutions plants began, however, to be considered from another point of view—from a strictly scientific standpoint, and as independent organisms. While the Aristotelian school studied plants in a manner closely approaching that of the present time, yet this beginning of biological science had no logical continuation, and during many succeeding centuries was completely lost to sight. In the latter half of the sixteenth century two new forces were manifest in the development of these institutions. Many of the wealthier class who had private gardens began to enlarge them by the addition of species because of their rarity, or because they were brought from some foreign country, and in many instances special collections were made chiefly for this purpose alone. Thus it may be seen that beyond the useful properties of plants, perhaps the first truly scientific idea of them concerned in a crude way some of the principles of geographical distribution. This phase of the subject received an increasing attention, and finally assumed form and order upon the introduction of the Linnæan system of classification into Germany and that of Jussieu into France.

Before this, however, a still more important development in the method of study of plants had ensued, as is shown distinctly in the botanical writings of the latter half of the sixteenth century. The all-important fact of the natural affinities of plants had gradually assumed distinctness—an idea not within the grasp of any one of the herbalists of the time, whose accumulating and repeated descriptions of individual species gave rise to the perception of resemblance and difference in forms, and finally to the idea of natural relationship. This idea finally became paramount: "All the foreign matter introduced into the descriptions of plants by medical superstition and practical considerations

were seen to be of secondary importance, and were soon thrown aside in the effort to establish a natural system of classification."

At the time of this "renaissance" of botany the gardens represented the ideas of geographical distribution and classification

THE BOTANIC INSTITUTE AT LEIPSIC, SHOWING ENTRANCE FROM GARDEN, AND GLASS COMPARTMENT FOR USE IN EXPERIMENTS WITH LIVING PLANTS. After a photograph. Reproduced by permission from the Minnesota Magazine, vol. ii, No. 1, 1895.

in addition to the practical aspects of the subject. With the development of physiology and morphology the ideas thus brought into prominence have found expression in the gardens, and the

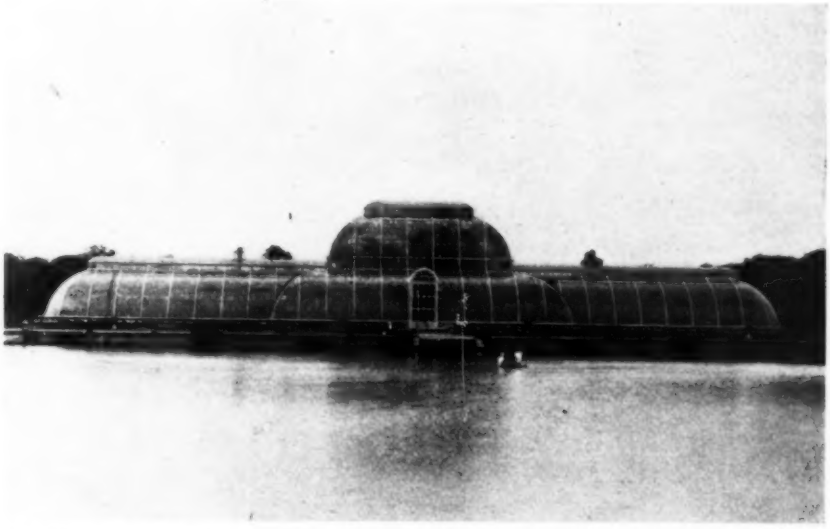
purposes and usefulness of these institutions have steadily broadened until all the more important phases of the subject are more or less represented in the greater majority of instances.

In addition to the scientific and practical uses enumerated above, the botanic garden has become a laboratory for the landscape artist, who may dispose of its masses of plants with a feeling regard for their artistic value in outline and color, making a most effective means of cultivation and gratification of public taste. In many of the better known gardens, especially those located in the great cities, this æsthetic feature has become a very prominent and in many instances the predominant idea.

Only when a botanic garden is equipped with laboratories for the furtherance of investigation, and sustains an organic relation to a school or university, may it be said to attain its highest possibilities of usefulness, in the demonstration of the principles governing the nature and development of one of the two great groups of living things. When designed for this purpose the collection of growing plants should represent as many of the principal forms of vegetation as is possible. Since the probable number of living plants is estimated at half a million, it is obviously impossible to bring together in any restricted area more than a fraction of this number. A census of the flora of the section of Bronx Park in New York, inclusive of about two hundred and fifty acres, which is to be converted into a botanic garden, showed that nearly a thousand species of ferns and seed-forming plants were to be found on that area, only a small number of which were introduced. Of these thousand species many were represented by thousands or perhaps hundreds of thousands of individuals. In the conversion of the tract into a botanic garden, the gardener will remove all but a few dozen, or perhaps a few hundreds, of each species, which will be confined to certain designated limited areas. In this way he will relieve each species from the competition of its neighbors, and so far as possible from the ravages of insects and animals—the most telling factors in the struggle for existence—and obtain space for the introduction of a large number of species. If these conditions alone determined the flora of a region, the number of species which could be grown in a garden would be determined only by its size and the number of plots it might contain. It is found, however, that the substratum and climate offer rigid limitations to an extension of the flora which may be grown out of doors in any locality. The gardener partially overcomes this limitation by the use of glass houses, where plants from nearly all parts of the world may be grown in specially prepared soils, and kept at temperatures resembling those of the natural habitats of the plants. But under such conditions it becomes extremely difficult to properly adjust the moisture and

light, and only a comparatively small addition may thus be made to the flora of a garden. The conditions described above are such that it has not been found possible to grow in one place more than fifteen thousand species of the higher plants. It will be found, moreover, that a large number of the species included are not able to attain normal stature and appearance, and will thus be useless in representing the form intended.

In consequence of this limitation of the number it is customary to supplement the living plants by collections of prepared specimens of contemporaneous and fossil forms, in order to rep-



THE MAIN PALM HOUSE OF THE ROYAL GARDENS AT KEW, WITH LAKE IN FOREGROUND.

resent more completely the vegetation of the globe. The living as well as the prepared plants are generally so assembled as to demonstrate the descent and relationship of the different groups, distribution over climatic and geographic zones, as well as their principal biological adaptations to the factors to be met in their native habitats. In addition to this strictly natural method of treatment it is also customary to illustrate by proper groups the forms which have become of special interest because of their food-furnishing, textile-yielding, medicinal, or other economic value. In order to accomplish these purposes a suitably equipped garden must contain, besides the necessary facilities for growing plants, museum buildings arranged for the display of prepared specimens, and if it designs to afford opportunities for research it must also be furnished with a library and laboratory facilities.

There are in the world more than two hundred institutions designed as botanic gardens, a large proportion of which are devoted to the cultivation of decorative plants, or subserve the use

of pleasure parks, while only a small number are organized on the broader basis of the needs of the branches of botanic science. Thirty-six of these institutions are located in Germany, twenty-

VIEW OF MAIN PORTION OF TEMPERATE HOUSE OF THE ROYAL GARDENS AT KEW.
In process of repair. After a photograph.

three in Italy, twenty-two in France, thirteen in Austria-Hungary, twelve in Great Britain and Ireland, and ten in the United States.

One of the most widely known is the Royal Botanic Garden at Kew, located on the south bank of the Thames, six miles from Hyde Park. The beginning of the Kew Gardens may be dated from the formation of the exotic gardens of Lord Capel in 1759. After a long series of changes in ownership and purpose, additions and alterations in plan, the gardens were transferred from a private possession of the crown to a national institution in 1840, with Sir William Hooker as the first director. About two hundred and seventy acres are included, of which seventy are planted as a botanic garden and the remainder as an arboretum and public park. Besides the large number of well-planned conservatories, greenhouses, museums, and other buildings, it contains a number of structures which reflect somewhat of the varied history of the institution. The main palm house is three hundred and sixty-two feet in length, with a central dome seventy feet in height (Plate IV), and the temperate house has a total length of five hundred and eighty feet, covering an area of an acre and a half of ground. In addition, the garden contains fourteen smaller glass houses. The herbarium and library, which occupy the old

palace of the King of Hanover, are probably the largest and most complete in the world. While the research work carried on in the gardens has been principally taxonomic, by the co-operation of the twenty-four gardens of which Kew is the organic head, much of value has been accomplished in the acclimatization of useful plants. There is also located in the garden the Jodrell Laboratory, in which some important results in physiology and morphology have been reached. Its operations, however, are greatly constrained by lack of suitable endowment.

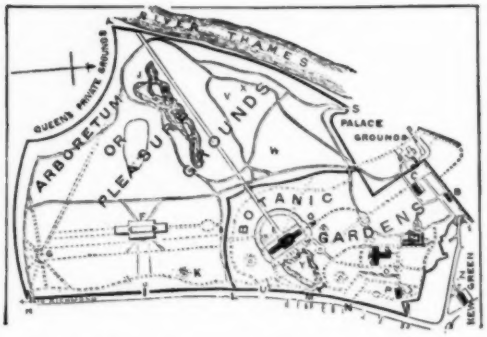
I quote the following explanatory paragraph from a guide to the grounds:

"It may be mentioned that Kew is not only a great educational establishment and pleasure resort, but also the recognized center of the various botanic gardens throughout the empire. The part it has played in the introduction of the cinchona into India, and in fostering various other important industries, is well known. It may be described as the great botanical clearing house of the empire. To it a large number of plants are constantly being forwarded from all parts of the world to be named,

THE CUMBERLAND GATE, ROYAL GARDENS AT KEW, WITH GUARD ON DUTY.
Looking outward. After a photograph.

for which purpose a staff of botanists is provided, and the collection of dried plants, or herbarium, as well as the large botanical library, is unrivaled throughout the world. In the same way the collection of cultivated plants and trees, both hardy and exotic, is the most perfect in existence."

The number of visitors to the gardens during the year amounts to one and a half million, according to newspaper reports. The gates, six in number, are open from noon until dusk. The administration and care of an establishment of this character near a great center of population require the closest organization and the most scrupulous attention to detail on the part of the executive. In this matter tradition as well as current testimony speaks of the rigid manner in which the numerous necessary regulations are enforced. The general plan of the grounds is shown in Plate VI.



PLAN OF KEW GARDENS. Explanatory references: A, principal entrance from Kew Green; B, tropical house; C, timber Museum No. 3; D, water-lily house; E, palm house; F, temperate house; G, pagoda; H, Lion or Richmond Gate; I, "North" gallery; J, lake; K, flagstaff; L, Unicorn Gate (closed); M, Museum No. 1; N, Cumberland Gate; O, rockery; P, Museum No. 2; Q, new range; R, succulent house, greenhouse, and ferneries; S, Brentford Gate; T, Ilesworth Gate; U, Victoria Gate, for Kew Gardens Station; V, bamboo garden; W, azalea beds; X, Rhododendron Dell; Y, ornamental water; Z, Kew Church.

When organized chiefly for research the botanic garden differs in many essential features from the one described above. From this point of view, and with regard to advantages of geographical position and botanical possibilities, the garden at Buitenzorg in Java occupies a foremost position. Originally founded by the Government of Holland in 1817, for the purpose of testing the economic value of plants indigenous to the colonies of the East Indies, and for the distribution of seeds, plants, etc., after the customary manner of such institutions, it has widened its scope and developed its facilities until almost all branches of purely scientific and applied botany may be pursued to advantage within it.

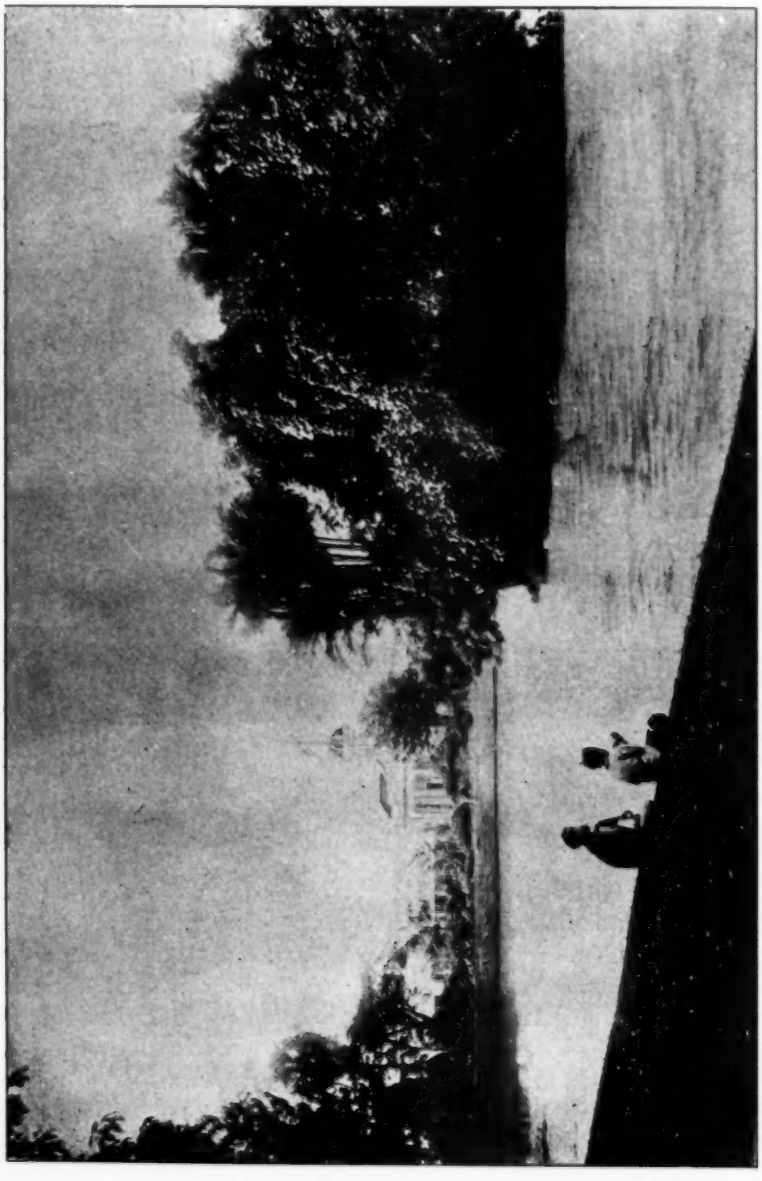
The Buitenzorg Garden is situated within a few degrees of the equator, and by reason of the elevated areas included within its different divisions furnishes suitable conditions for the growth in the open air of plants native to latitudes as high as forty or fifty degrees. The luxuriance of the growth of plants in the lower tropical area may be imagined when it is stated that the average temperature is 85° Fahrenheit, and the yearly rainfall amounts to twelve feet. Of the eleven hundred acres available for the purposes of the garden, an area of about one hundred and seventy-three acres is devoted to experiments with cultivated plants, one hundred and forty-eight to the botanic garden proper,

seventy-five to a mountain garden at an elevation of about seven thousand feet, and the remainder is comprised in a mountain forest. The laboratories are most excellently equipped for investigation in forestry, agricultural chemistry, and pharmacology, besides the main divisions of the pure science. In addition to a very complete library and herbarium, the administration has at its service a lithographic establishment for the preparation of illustrations for its publications. It would be difficult to overestimate the value of the results accomplished by the various divisions of this institution, or to predict its future performances. By reason of its facilities and resources it has become a Mecca for the botanists of the world.

The foundation of a botanic garden in the United States dates from that of John Bartram in Philadelphia in 1728, which is still preserved in a modified form. Botany has been given an important place in the college curriculum in America scarcely more than sixty years. In comparatively recent years a few gardens have come into existence, nearly all of which are still in a state of rapid development. During this period of flux they have been able only to afford facilities for general elementary instruction, and to make possible original work in the classification of native plants—a line of research which has been carried on more or less steadily since the earlier settlements were made on this side of the Atlantic. At the present time a few have begun to offer opportunities for research in the more important branches of botanical science. Among these may be mentioned the Missouri Botanical Garden at St. Louis, connected with the Washington University, the Botanical Garden and Arnold Arboretum of Harvard University, and the Botanic Garden of New York, now in process of formation and to be connected with Columbia University.

The Botanic Garden of Harvard University was established in 1805. It has an area of seven acres, on which are cultivated about seven thousand species of plants, principally native. For this reason it finds but one greenhouse necessary. The garden contains the famous herbarium and library in which Asa Gray accomplished his work on the plants of North America. The main laboratories and museums are located in the university buildings. Some very important work on the morphology of the cryptogams has been published from these laboratories. The Arnold Arboretum of Harvard University is organized entirely independent of the botanic garden. It includes an area of two hundred and fifty acres, of which one hundred and sixty are planted with trees and shrubs. It is furnished with a museum, herbarium, and library, for the purpose of aiding study and research in forestry and dendrology. By an arrangement with the city of Boston the arbore-

tum is thrown open to the inhabitants of that city as a public park. The arboretum has nearly completed a description of all the trees of North America north of Mexico in a series of



ISLAND AND LAKE IN BOTANIC GARDEN, BUITENZORG, JAVA. Reproduced from "Der Botanische Garten 's Lands Plantentuin zu Buitenzorg, Java. Festschrift zur Feier seines 75-jährigen Bestehens," 1893.

magnificently illustrated quartos, entitled The Silva of North America.

The foundation of the Missouri Botanic Garden at St. Louis is due to the munificence of Mr. Henry Shaw, who bequeathed for that purpose a tract of seven hundred and sixty acres of land and

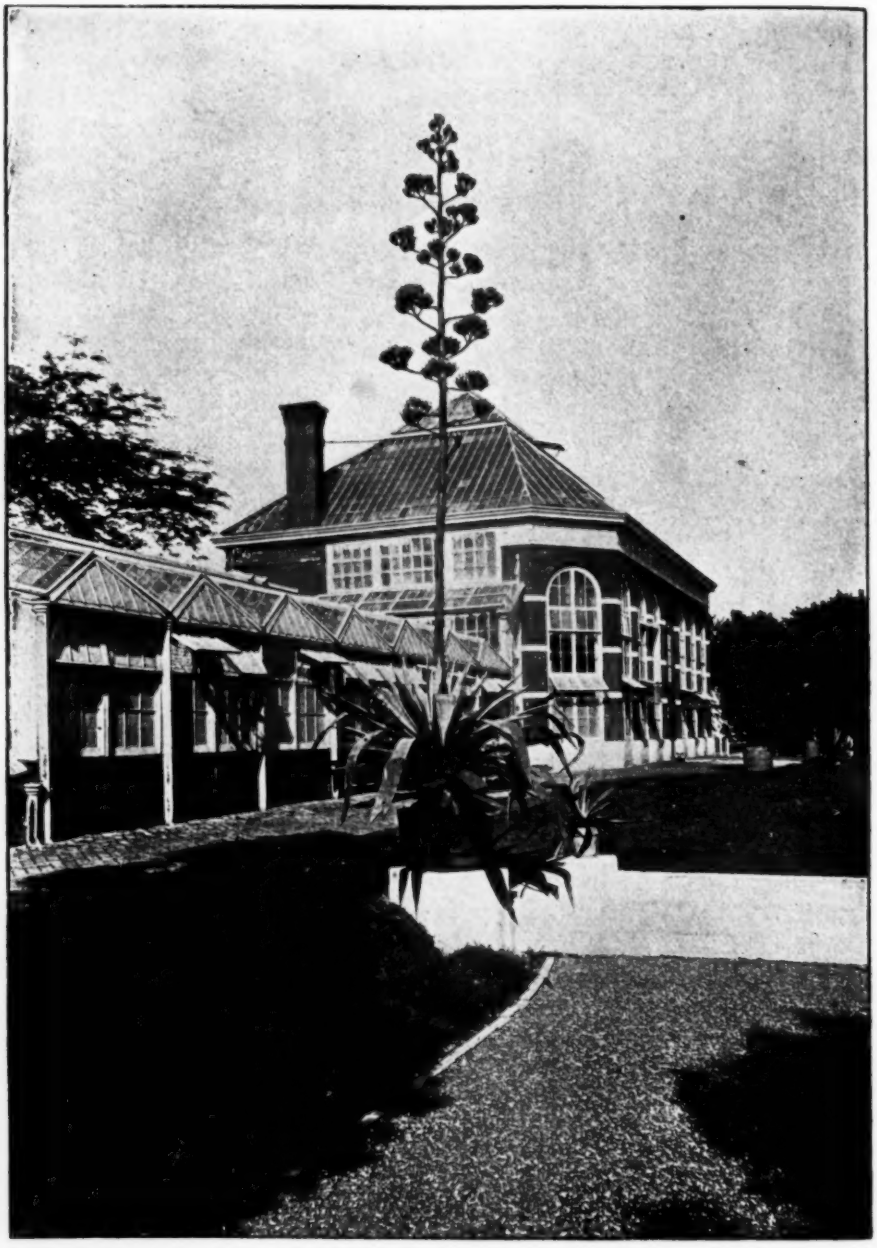
other property in and near St. Louis. The scope of this institution may be best illustrated by the following quotation from the will of its founder: "With a view to having for the use of the public a botanical garden, easily accessible, which should be forever kept up for the cultivation and propagation of plants, flowers, fruit and forest trees, and other productions of the vegetable kingdom, and a museum and library connected therewith, and devoted to the same and to the science of botany, horticulture, and allied objects." It is connected with the Washington University, which has a School of Botany also endowed by Mr. Shaw in 1885. The botanic garden occupies an area of forty-seven acres. The grounds are laid out in such a manner as to be highly attractive, and as many as thirty thousand people have passed the gates in a single day. Much important work in plant taxonomy has been accomplished in this institution, and the facilities for work may be set forth in the following official statement:

"The herbarium is supplemented by a large collection of woods, including veneer transparencies and slides for the microscope. The library, containing about eight thousand volumes and ten thousand pamphlets, includes most of the standard periodicals and proceedings of the learned bodies, a good collection of morphological and physiological works, nearly five hundred carefully selected botanical volumes published before the period of Linnæus, an unusually large number of monographs of groups of cryptogams and flowering plants, and the entire manuscript notes and sketches representing the painstaking work of Engelmann.

"The great variety of living plants represented in the garden and the large herbarium, including the collections of Bernhardi and Engelmann, render the garden facilities exceptionally good for research in systematic botany, in which direction the library also is exceptionally strong. The living collections and library also afford unusual opportunity for morphological, anatomical, and physiological studies, while the plant-house facilities for experimental work are steadily increasing. The E. Lewis Sturtevant Pre-Linnæan Library, in connection with the opportunity afforded for the cultivation of vegetables and other useful plants, is favorable also for the study of cultivated plants and the modifications they have undergone."

The New York Botanic Garden is the most recent acquisition to the list of these institutions in America. Its establishment was authorized by the Legislature in 1891, but the enabling act being defective, no steps could be taken in its organization until 1894. To comply with the act of incorporation, a sum of two hundred and fifty thousand dollars was raised by private subscription, and then the Commissioners of Public Parks of New York City were authorized to set aside two hundred and fifty

acres of Bronx Park, and the Board of Estimate and Apportionment was directed to issue bonds amounting to five hundred thousand dollars, to be used in the construction of the necessary buildings, greenhouses, museums, laboratories, etc.



VIEW OF MAIN GREENHOUSE IN THE MISSOURI BOTANIC GARDEN, WITH FLOWERING SPECIMENS OF AGAVE MEXICANA IN FOREGROUND. Reproduced by permission from the Fifth Annual Report of the Missouri Botanical Garden, 1894.

The scope of this institution may be best illustrated by the following extract from the act of incorporation: "To be located in the city of New York for the purpose of establishing and maintaining a botanical garden and museum and arboretum therein, for the collection and culture of plants, flowers, shrubs, and trees, the advancement of botanical science and knowledge, and the prosecution of original research therein and in kindred subjects, for affording instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation, and instruction of the people." The site of the garden embraces an area of such wide diversities of soil and slope, marsh, meadow, shores, and granite ridges, that it will afford peculiarly fitting conditions for the growth of an extensive flora in the open air. As mentioned above, about one thousand species of plants, nearly all of which were native, were found on the inclosed area at the time of organization of the garden. Through a co-operative arrangement entered into with Columbia University, the herbarium of this institution, numbering over six hundred thousand specimens, as well as the library, will be deposited with the garden, and most of the research and graduate work of the university in botany will be carried on in the museum building. The plans of the museum building are such as to offer ample facilities for laboratories in all the divisions of the subject, while the glass houses promise to surpass anything in existence at the present time. The conditions of organization are such that a high efficiency for the entire equipment will be at once attained. The establishment of this garden marks an important step in the development of botany in America.

Perhaps the greatest opportunity for furthering botanical investigation that has existed since the beginning of the science now confronts the American universities in the proposal to establish a botanic garden and laboratory in the tropics. The real value of such an institution may be best understood when it is stated that botany in its present elementary condition, especially with reference to the physiology and ecology of plants, is based chiefly on the results of investigations carried on in botanical gardens and laboratories situated in the northern hemisphere between the parallels of forty and fifty-five degrees. In the herbaria it has been possible to study normal specimens of prepared plants from the equator to the poles, and consequently the systematic relationships are much better known than any other characteristic. Morphology has shared these advantages to some extent.

In the study of the physiology, ecology, and other branches of the science in which living plants are necessary, attention has been

necessarily confined to those indigenous to a zone fifteen degrees in width, extending across one small continent and half way across another, together with introduced species growing under more or less abnormal conditions in gardens and conservatories. As the science progresses it is becoming more and more apparent that many of the generalizations based upon investigations carried on under such circumstances are incapable of general application, and that before a permanent foundation for the science can be laid, research along all lines must be extended to include the most highly developed forms, in the primitive habitat of the plant kingdom, in the tropics. The principles of the relations of plants and their relations to the animal kingdom may only be attained by the study of undisturbed communities of plants in the natural groupings resultant from the struggle for existence. Here are to be found such rapidity of growth and metabolism that the adaptive possibilities of the organism reach their highest expression.

The centers of botanical activity in Europe are so far removed from a tropical flora that only occasionally does a transatlantic investigator find time and opportunity to extend his researches to include normal tropical forms. To do this he must visit Buitenzorg or some other garden nearly half way round the world.

The center of botanical activity in America has at its very doors a tropical region (in the West Indies), unsurpassed in every feature, which may be reached in four or five days from any important city in the country. The establishment of a laboratory and garden in any convenient locality would not only be of untold value in the general development of botanical science, but it would place within easy reach of the investigator or graduate student in American universities facilities unequaled by that of any other country.

The European botanist would also find a laboratory in the American tropics much more easily accessible than those of the antipodes. The foundation of such an institution would be of direct benefit to the greater number of active botanists, and would go far toward making America the scene of the greatest development of the biology of one of the two great groups of living organisms.

A FELICITOUS tribute was paid to Darwin at the opening of the English Church Congress in Shrewsbury, the philosopher's birthplace, by the Bishop of Lichfield, presiding, who said that "all members of the Church of Christ owed a great debt of gratitude to Charles Darwin. He had simplified and interpreted, as a true man of science would be anxious to do, the methods which have been pursued by the Great Almighty Creator in his works, and in so doing he had added to the dignity of the conception which they were able to form of Him who made us and all the world."

ANIMAL SYMBOLISM IN ECCLESIASTICAL ARCHITECTURE.*

By ANDREW D. WHITE,
EX-PRESIDENT OF CORNELL UNIVERSITY.

PROF. EDWARD P. EVANS is already well known to the readers of the Popular Science Monthly as a contributor of historical and psychological articles especially valuable and interesting.

His position upon the editorial staff of one of the most important European journals gives him extraordinary opportunities to discern events having a real bearing upon contemporary thought. As a scholar deeply interested in the most important modern questions, he has for several years past interpreted to Germany the significance of current American history and literature, and at the same time he has kept thoughtful Americans informed regarding various important political and philosophical developments in the New Germany, and in Europe generally.

This latest of his works is one for which every student of history, in its largest and best sense, should be grateful to him. Under the title of Animal Symbolism in Ecclesiastical Architecture he has thrown a bright light into the evolution of thought during the middle ages, and at the same time into the whole course of human development; and his book is not only learned but interesting; so that it will not only prove profitable to scholars but attractive to the general reader.

Many a ponderous and voluminous work on mediæval history and art, requiring months for its study, is really far less valuable than this little book, which can be read delightfully by the fireside during the winter evenings of a single week.

The great majority of thinking Americans who travel abroad are naturally attracted and impressed by the mediæval cathedrals. Representing the most profound and brilliant phase of architecture, these great creations attract even those who have little feeling for art in general. Among all structures reared by man they take strongest possession of thoughtful minds.

Yet few, even of the most attentive, see in them their full depth of meaning. Even the most scholarly traveler has been wont to give up some of the most interesting cathedral problems in despair. By the side of some sculptured group of heavenly beauty he sees masses of carving, grotesque, and not infrequently profane and even obscene. He can not understand why a sculp-

* Animal Symbolism in Ecclesiastical Architecture. By E. P. Evans. With a Bibliography and seventy-eight Illustrations. New York: Henry Holt & Co., 1896.

tor who seems to have caught sight of cherubs and seraphs should suddenly revel in the creation of devils, imps, and animals, real and imaginary. The whole seems an incongruous jumble. This jumble, and much else, Prof. Evans interprets to us, and shows us how all grew naturally out of human thought and aspiration.

The key which he furnishes us to these strange problems presented by mediæval art is mainly the old dogmatic relation between Nature and Scripture. In the early Church the science of Aristotle and his successors was speedily turned into a channel of which they never dreamed. Scientific truth ceased to be studied for truth's sake, but was used to ascertain and illustrate the meanings of the Bible, and to establish the dogmas of the Church. The book of Nature was held more and more to be the counterpart, and therefore the interpreter, of the book of Revelation. The visible creation was held to be a mirror of the spiritual realm. Hence a new and most extraordinary growth, which, while it has been supplanted in our time by the blooming forth of modern science, still shows some lingering blossoms.

Very early in the history of the Church appeared the treatise known as the *Physiologus*. In this, various objects in Nature were made to interpret and to be interpreted by various passages in Scripture. So successful was this work that there grew out of it great encyclopædias of sacred science, and the historical student still finds in all properly furnished university libraries works of such vast scope as those of Vincent de Beauvais, Thomas de Cantimpré, and Gregory Reysch.

Most important among the early sources of this stream of mediæval thought was Origen. Early in the third century that eminent biblical scholar, profound and prolific, laid down a great doctrine, as follows: "The visible world teaches us concerning the invisible; the earth contains images of heavenly things, in order that by means of these lower objects we may mount up to that which is above. . . . As God made man in his own image and after his own likeness, so he created the lower animals after the likeness of heavenly prototypes." *

The main biblical basis for this great statement was found in two passages, one from the Old Testament, the other from the New. The first was the text from Job, as follows: "Ask now the beasts, and they shall teach thee; and the fowls of the air, and they shall tell thee." This outburst of poetry, from perhaps the most profound poem in human history, was taken as a prosaic statement of truth. The other text was the statement of St. Paul, that "the invisible things of Him from the creation of

* See Evans's work cited, p. 28.

the world are clearly seen, being understood by the things that are made."

The result was that the *Physiologus*, which interpreted the sacred significance of the animal kingdom, had a wider circulation than any other book save the Bible, and was translated into the languages even of the remotest Christian peoples.*

It will appear strange to any one not well acquainted with the ways of mediæval thinkers that the animal which had perhaps the earliest and greatest significance was one which existed neither in the Bible nor in Nature, but which was evolved by early Christian thought, brooding over statements which came from the sun worship of earlier nations and from pagan literature. This animal was the phœnix; it was made to teach a world of church doctrine, and was even stamped upon the coin of the first Christian emperor.

In the twelfth century we have, as an outgrowth of the *Physiologus*, the *Bestiaries*. These developed this theological learning still further, and now it comes in with a full tide. The sculptures of cathedrals, the paintings on stained glass, the illuminations of manuscripts, the embroideries of vestments, are all filled with phœnixes, unicorns, salamanders, as well as with the whole range of animals having real existence.

Of animals having real existence, the lion was perhaps most frequently sculptured, and regarding him the *Physiologus* is especially explicit. Among other things it ministers to edification as follows: "First, when the lion perceives that the hunters are pursuing him, he erases his footprints with his tail, so that he can not be traced to his lair. In like manner our Saviour, the lion of the tribe of Judah, concealed all traces of his Godhead when he descended to the earth. Secondly, the lion always sleeps with his eyes open; so our Lord slept with his body on the cross, but awoke at the right hand of the Father. Thirdly, the lioness brings forth her whelps dead and watches over them, until after three days, the lion comes and howls over them and brings them to life by his breath; so the Almighty Father recalled to life his only begotten Son, our Lord Jesus Christ, on the third day."

Another animal which we constantly find lurking in the sculptured foliage of cathedrals is the lizard. Regarding this the *Physiologus* informs us that in its old age it becomes blind, creeps into some crevice looking eastward, and, beholding the rising sun, is restored to sight: on this the mediæval naturalist advises us: "In like manner, O man, thou who hast on the old garment, and the eyes of whose heart are obscured, seek the wall

* See Evans, p. 62.

of help, and watch there until the sun of righteousness rises with healing power and removes thy spiritual blindness."*

Mixed in with real animals come those whose existence is more doubtful. Great stress was laid upon the unicorn, and John of Herse, in his pilgrimage to Jerusalem toward the end of the fourteenth century, declares regarding the river Mara, whose bitter waters Moses made sweet, that "even now, evil and unclean beasts poison it after the going down of the sun; but in the morning, after the powers of darkness have disappeared, the unicorn comes from the sea and dips his horn into the stream, and thereby expels and neutralizes the poison, so that the other animals can drink of it during the day. This fact, which I describe, I have seen with my own eyes."

Naturally, among the animals which first attracted the attention of those who thus expounded the ways of God to man was the elephant. First, as to its birth, we are told that it takes place in the water, and that this fact symbolizes baptismal regeneration. Then, too, we are told that the elephant "always sleeps standing, and leans for support against a tree. The hunters take advantage of this fact and saw the tree almost asunder, so that the tree gives way, the elephant falls, and is captured. This evidently symbolizes Adam, whose fall was caused by a tree."

The serpent, of course, comes in for a large share of this kind of interpretation, and therefore appears most frequently among the carvings in wood and stone, both within and without the cathedrals.

As to the lessons thus taught, one of the first is that "when the serpent has grown old it fasts forty days and forty nights until its skin shrivels and loosens. Thereupon it squeezes itself through a narrow crevice in the rocks, and thus casts its skin and renews its youth. And thou, O son of man, if thou desirest to put off the old Adam and be regenerated, must pass through the strait gate and walk in the narrow way which leadeth unto life."

And again: "When the serpent goes to a spring to drink water, it leaves its venom behind in its den; so he who would refresh his soul with the waters of eternal life must leave behind him every sin of his carnal heart." †

Of course, in any such pious treatises the eagle naturally came in for a considerable share of attention, and we are informed that "the eagle, when it has grown old and its eyes become dim, flies upward toward the sun until it has purged away the film from its eyes; it then descends to the earth, plunges three times into a spring of pure water, and thus recovers its sight and renews its youth"; so the Christian should "fly aloft on the wings of the

* See work cited, p. 94. † See work cited, p. 114.

spirit to the sun of righteousness, . . . and then dip himself thrice in the well-spring of salvation."

Again, one version of the *Physiologus* tells us that the upper beak of old eagles grows so long that it would prevent them from eating and cause them to die of hunger did they not break off the superfluous part of the beak against a stone; and on this alleged fact is based the statement that "the rock of salvation is the only cure for the growth of carnal-mindedness, and the sole means of preventing spiritual starvation."

Of marine animals the early Christian philosophers knew little, but naturally they had heard of the whale, and found important meanings in him. One of the lessons taught by the whale is given as follows: "When he is hungry, he opens his wide mouth seaward and a pleasant odor issues from his maw, so that other fishes are deceived and swim eagerly toward the place whence this sweet odor comes. In heedless shoals they enter into his extended jaws; then suddenly the grim gums close and crush their prey. Thus the devil allures men to their destruction and closes upon them the barred gates of hell."

The mediæval imagination played curiously about the pelican. A type of the atonement was found in the supposed fact that the pelican tears open its breast and feeds its young with its own blood. New value was given to the pelican by that great thinker, St. Augustine. Writing upon the passage in the one hundred and second Psalm—"I am become like a pelican in the wilderness"—he says: "The males of these birds are wont to kill their young by blows of their beaks and then to bewail their death for the space of three days. At length, however, the female inflicts a severe wound on herself, and, letting her blood flow over the dead ones, brings them to life again."

Naturally, this statement, coming from a man so widely venerated, proved a great source of inspiration to the pious writers and sculptors of the middle ages.

The otter and the crocodile also attracted the attention of these pious writers, and they developed in good faith the following statement: "When the crocodile sleeps, it keeps its mouth open; but the otter wallows in the mire until it becomes thickly coated with mud, which dries and hardens and forms a sort of armor, thus enabling it to run securely into the jaws and down the throat of the sleeping crocodile, and to kill it by devouring its bowels. So our Saviour, after having put on flesh, descended into hell and carried away the souls dwelling therein; and, as the otter comes away unharmed from the belly of the crocodile, so our Lord rose from the grave on the third day, alive and uninjured." *

---

* See work cited, pp. 131, 132.

Interesting also is the pious use made of the panther. Of this beast it is said: "It is the nature of the panther to live in friendship with all animals except the dragon. . . . When it has eaten a little it is satisfied and goes to sleep in its lair, and after three days it awakes and roars with a loud voice, and out of its mouth proceeds a sweet smell; then all the beasts of the forest far and near follow after it," but "this rare scent is offensive only to the dragon, which hastens to flee as soon as it gets a sniff of it. In like manner our Lord Jesus Christ arose out of the sleep of death and drew all nations unto him through his 'sweet savor.' But this same savor discomfits the dragon, that old serpent which is the devil." The very curious statement regarding the beaver is perhaps best read in the original, where it is illustrated by a striking engraving. It serves to show that some cathedral sculptures usually considered obscene were not so intended.

Of course, the domestic fowls could not escape the notice of these keen interpreters of theology and science. We may take as typical the following: "When the cock finds anything, it does not eat it, but calls the hens together and divides it among them. In like manner the preacher should distribute among his flock the kernels of divine truth which he discovers in Holy Writ, picking them to pieces in order that they may be more readily taken in and digested." *

Very curious are sundry long and intricate developments of theory regarding various animals. One of these was evolved out of the beautiful text, "As the hart panteth after the water-brooks, so panteth my soul after thee, O God." The *Physiologus* tells us that "the hart is the foe of the dragon, which, when it sees its enemy, runs away and creeps into a cleft of the rocks. Then the hart goes to the stream, fills himself with water, and vomits it into the cleft where the dragon is. Having thus drowned the dragon, the hart tramples it under its feet; as the prophet Isaiah predicts that at the coming of Christ a man shall 'go into the clefts of the rocks and into the tops of the ragged rocks, for fear of the Lord.' Thus our Saviour slew with the water and blood flowing from his side the great dragon, . . . and taught us to contend against the hidden designs of the devil."

A comical *quasi*-scientific profundity is at times mixed up with these statements. Thus some commentators upon Scripture declare that "the hart, in killing the dragon, inhales its poisonous breath, which produces intense thirst and consequent longing for the water-brooks."

So, too, regarding the antelope, we are told that "the antelope

* See the curious mediæval poem given at page 162.

is a wild animal with two powerful horns, with which it saws trees asunder and fells them. . . . The two horns are the books of the Old and New Testaments, with which the believer can resist the adversary and push him to the ground, and can cut down all growing sins and vices." Mingled with this statement are a number of subordinate lessons.

Very curious among these developments of the pious mediæval imagination are the barnacle geese, as described in the Bestiaries. It is declared that "they grow on trees by the seaside, and hang from the boughs by their beaks until they are covered with feathers and fall like ripe fruit. If they reach the water, they swim and live; but if they remain on the dry ground, they perish." Naturally, this illustration was used with great force to prove the efficacy of baptism in saving the soul, and Gerard of Wales made a curious use of it to prove the doctrine of the Immaculate Conception.

Very justly and aptly does Prof. Evans call attention to the fact that some of the dogmas which have long obscured and even supplanted Christianity, and which are still insisted upon as substitutes for the Christianity taught by Christ himself, were devised and handed down to us by the very thinkers who developed these legends and made this pious use of them.

But another very interesting field is opened by the use of mediæval sculpture for satirical purposes. The growth of it in this direction begins to be especially evident in the thirteenth and fourteenth centuries, and it culminated about the time of the Reformation. Monkeys appear as choristers, swine as monks, asses as priests, sirens as nuns, wolves as the father confessors of lambs. In one painted window a fox is represented preaching to a flock of geese from the text, "God is my witness how I long for you in my bowels." In Ely Cathedral a fox is represented arrayed as a bishop. Here comes in what has so astounded many travelers—the apparent obscenity of some of these representations. Gentlemen who have visited some of the greater cathedrals are hardly likely to forget the leer with which the sacristan sometimes raises the wooden seats of the choir, or points to a bit of carving in a corbel, which seems the result of the grossest license. It was really the outgrowth of the same bitter feeling against the growing corruptions in the Church, which led such pious preachers as Geyler of Kaisersberg to speak in the plainest terms against the same evils.

Various writers in these days have found fault with Luther for the grossness of some of his utterances, but as we note these earlier representations in art and Christian literature we see that his diatribes were but a natural evolution out of an earlier Catholic phase of thought.

Among the animals which took a leading part in mediæval sculpture at this period was the fox, and a text of the *Physiologus* was widely translated into sculpture. This text ran as follows: "When the fox is hungry, it lies down in a furrow of the field and covers itself partly with earth, as though it had been long dead. Then the ravens and other rapacious birds come to devour it, when it suddenly leaps up and tears them to pieces. Thus the devil deceives those who love the corrupt things of this world and obey the lusts of the flesh, and entices them to their own destruction." Representations of this scene and others in which the fox plays a leading part are very common in the later mediæval sculpture. In Worcester Cathedral is a carving showing foxes running in and out of holes, while John the Evangelist stands near with his gospel in his hand and an eagle at his feet. Here the foxes are types of the devil, and John the Evangelist the herald of divine truth. In Canterbury Cathedral are sculptures representing a fox dressed like a monk and preaching to an assembly of geese.

Very severe at this later period were some of the caricatures by devout Catholic sculptors upon the begging friars. In the church of St. Victor at Xanten are carvings in which is represented a monster with the feet of a pig, the tail of a fox, and the head of a monk.*

The ass was also used for a similar purpose. Thus, on a column of St. Peter's Church at Aulnay an ass is represented as standing on his hind legs and clothed in ecclesiastical costume. Even in so devout a country as Spain, and in such a theological center as the Cathedral of Toledo, we find striking examples of this same satirical spirit; and at the Cathedral of Burgos are sculptured satires no less striking, against vice and folly.

More and more frequently throughout Europe we have in sculpture these figures of foxes preaching to fowls, with other foxes lying in wait behind the pulpit to catch the congregation; of asses wearing rosaries, of donkeys playing upon the lyre, of pigs playing upon the bagpipes, of foxes confessing birds, and of wolves confessing sheep; and these appear not only in sculpture, but in other forms of art. In the collections at Cornell University are some very curious specimens. A very rare missal, obtained by the writer of this article in Germany some years since, is full of illustrations of this kind.

Very interesting is the final chapter of Prof. Evans's work, entitled Whimseys of Ecclesiology and Symbology, and among these the reader will doubtless most rejoice in the extracts from a paper on Vestiges of the Blessed Trinity in the Material Crea-

* See work cited, p. 224.

tion, published in the Dublin Review for January, 1893, by the Rev. John S. Vaughan, who finds traces of this doctrine "'written large across the whole face of Nature,' and everywhere suggested by 'such familiar things as rocks, mountains, seas, and lakes.'"

This reminds us of Mr. Gladstone's famous discovery that the trident of Neptune, in some occult manner, symbolized the Christain Trinity; the trident being, after all, nothing but the most natural form of fish spear, devised in consequence of the fact that, owing to the refracting power of water, a single spear head is not likely to be so useful in catching fish as one with three prongs.

Into the concluding chapter of the work is brought a bird which greatly exercised the mediæval imagination—the peacock. A text is cited from the *Physiologus* to the effect that "when the peacock wakes suddenly in the night, it cries out as if in distress, because it dreams that it has lost its beauty, thus typifying the soul, which in the night of this sinful world is constantly fearing to lose the good gifts and graces with which God has endowed it." Perhaps one of the most curious typical examples of ultra-theological reasoning is seen in the pious argument of the Bestiaries that "the tail of the peacock denotes foresight, since the tail, being behind, is that which is to come; and foresight is the faculty of taking heed to that which is to come."

Much light is thrown into mediæval ideas, also, by other sculptures, especially those representing Satan. This, indeed, opens a great chapter, and a chapter which was by no means concluded at the Reformation. Undoubtedly a considerable part of Luther's theology regarding the devil was drawn from this source. The writer of this article, some years since, staying for a time at Wittenberg, and being frequently in the great church where Luther so often preached, noted directly opposite the pulpit a sculptured imp emerging from a mass of carving. Nothing could be more natural than that the great Reformer, wearied with other themes, should by this and similar sculptures in other churches be constantly drawn off from his main subject to his well-known denunciations of Satan and satanic influences.

It should be remembered that in the ages before printing the cathedral sculptures took, for the people at large, the place of the printed book. Robert de Luzarches and Erwin von Steinbach, who built, preceded Faust and Schoeffer, who printed. Victor Hugo recognized this when he pictured his Quasimodo, the Hunchback of Notre Dame, as absorbed in the study of the series of sculptures about the choir of that cathedral. The special value of Prof. Evans's book lies in the fact that, like Prof. Crane's book on the *Exempla* of Archbishop Jacques de Vitry, it enables the American reader to get really into the thoughts of

his ancestors who worshiped in the cathedrals. For the general thinker, also, such works are of real use, as revealing more and more clearly that all progress in thought is the result of an evolution which is by no means to cease in our time.

Prof. Evans's work is thus valuable, not only to the student of art and literature, but to every one who wishes to penetrate the meanings of history in general. The writer of this article, having visited and studied nearly every cathedral and church of any importance from Throndhjem to Palermo, and from Dublin to Moscow, can vouch for the exactness of the statements made in this little book; and it should be added that the learned professor has attached to it a bibliography which, to any one who wishes to carry this fascinating subject still further, will prove most helpful.

TWO SCIENTIFIC CONGRESSES.

By J. MARK BALDWIN,
PROFESSOR OF PSYCHOLOGY, PRINCETON UNIVERSITY.

THE pursuit of science does not stop in summer, and those who go abroad for rest or recreation find that science pursues them. It is a very profitable form of science which is thus prosecuted in summer, however, and that in two respects: for, in learning science in a summer congress, one gets the things which the best men oftentimes save up for just this or that occasion, and then again one gets the men thrown in. This latter fact is really the redeeming feature of a scientific congress. It is appreciated, too; and the social side of the congress idea has had such development that it is a question whether the fatigue incident to the attendance upon the social functions does not sometimes enervate the scientist when he should be mentally most brave and sharp.

The International Congress of Experimental Psychology, of which I shall first speak, certainly touched the summit of social privilege, as a citizen in any monarchy would certainly agree, since certain of the members were given a dinner in Munich—the seat of the congress—by the reigning house in the person of Prince Ludwig Ferdinand of Bavaria, himself a man with a medical degree and the author of sundry medical monographs. This, together with the official reception by the city of Munich and the many other private and collective entertainments, will make this meeting memorable to those who had the good fortune to attend it. It was a chance, too, to meet almost every great—or less great—worker in the various departments of psychology in Germany.

The organization of an international congress for psychology

dates back to 1888, when the first assembled in Paris under the presidency of Prof. Th. Ribot, of the Collége de France. It was devoted very largely—and that intentionally—to two topics which were then uppermost in the French psychologists' minds: hypnotism and telepathy. Very few Germans were there. Of English-speaking delegates, Prof. Sidgwick, of Cambridge, and Prof. James, of Harvard, who were the two best men at that time—as they are yet—interested in both these subjects, were prominent. The second meeting was in London, in 1892, under the presidency of Prof. Sidgwick—a large and profitable meeting; and it is significant of the change that had come over the *personnel* of the congress, as well as of the growth of ideas in the interval between the two meetings, that at this second session the name of the organization was changed from "Congress of Physiological Psychology" to "Congress of Experimental Psychology." For at the London meeting the range of topics was greatly broadened; both hypnotism and telepathy took a much less prominent place; and all the varied branches of psychological work came in for treatment, especially the purely academic experimental psychology of the laboratory.

The third session of this congress, held August 6th to 9th in Munich, showed the same development, and so became the great unrestricted body that it should be. All departments of psychological investigation were adequately represented in the five sections into which it was found necessary to divide the more technical papers; while the general sessions, devoted to topics of more universal interest, were full and most instructive. Indeed, the president found it necessary to repeat what the former presiding officer had said in London, that the word "experimental" in the title of the body did not describe laboratory work alone, but all investigations into mental things which were conducted by competent men in accordance with inductive scientific methods. This range is shown by the titles of the five sections referred to: "Neurology, the Senses, Psychophysics"; "Normal"; "Abnormal"; "Dreams, Hypnotism"; "Comparative and Educational." Consequently, at the Munich Congress the word "experimental" was dropped from the official designation of the body.

The work of the general sessions was interesting to a wider circle than that of the professed psychologists, in several respects. The president, Prof. Stumpf, of Berlin, discussed the relation of mind and body in a way which may be profitably read by those moderately versed in philosophy. His address has since appeared in full in the *Revue Scientifique* of Paris, and will also appear in full in the Proceedings of the congress. Prof. Richet, of Paris, discussed "Pain" in a way which did not throw much light on the subject, and his paper has also come out in the *Revue Scientifique*.

Prof. Ebbinghaus presented an interesting new method of testing the mental capacities of school children, which I have already outlined in the Nation for September 10th.

President Hall, of Clark University, was to speak in one of the general meetings, but did not attend. Prof. Preyer, who is known for his excellent books on the child's mind, presented a general treatment of "The Psychology of the Child."

In the sections much exact work was done. It would be impossible, in the space I have, even to cite the different papers; so I shall have to leave the reader to consult them in the Proceedings. There were, besides the regular programme, several things of the nature of "side shows" which deserve comment. In the first place, there was an exhibition of apparatus, containing many interesting and some new things, under the charge of Dr. Marbe. Then the members of the congress were treated to a demonstration of the Röntgen ray effect which has possibly not yet been surpassed anywhere. Led into a dark room, the observer was stationed before a prepared screen about two feet square or more, and behind the screen a boy was gradually passed at the same time that the Röntgen rays made the screen fluorescent. The shadow outlines of the internal organs of the boy were clear—lungs, heart, etc.—and the movements of these organs in regular rhythm were plainly seen. This exhibition excited great enthusiasm among the members of the congress. Another rather sensational "side show" was the exhibition made of an Indian yogi, who went off into his sleep in a private room for the edification of some of the psychologists.

The next psychological congress is to meet in Paris in 1900, in connection with the French Universal Exposition. Prof. Ribot, who is considered the official representative of psychology in France, is again made president, and M. Ch. Richet vice-president. M. Pierre Janet will be secretary. The international committee for the next meeting has four American representatives—Profs. James, Hall, Titchener, and the present writer. There seems to be a general feeling that America should have the congress soon; indeed, the going to Paris for a second session is a matter of special consideration in view of the coming exposition.

The other congress of which I have promised to write briefly is that of "Criminal Anthropology": the fourth, which met in Geneva in the last week of August. This congress has had about the same lease of life as that for psychology, the earlier sessions having been held in Paris, Rome, and Brussels. It aims to be official, and invitations to take part are sent to the different Governments. This year quite a remarkable array of governmental appointees were in attendance. It seems that this policy is somewhat doubtful, from the point of view of science, since

the Governments are sometimes disposed to take what representatives they can get in order to save expense; and, besides, their appointees are likely to be men whose interest is rather in the practical and administrative side of criminology than in the purely scientific side. I am far from meaning by this to make any disparaging reference to the Government representatives in the congress of this summer, but only to say that the general policy is likely to give the development of the work of the organization a set in a practical rather than a scientific direction. This, indeed, already shows itself in the work of the congress. Of course, a congress on administrative criminology—there has been a congress on "Prison Reform"—would be a good thing; but what criminology as a science needs the rather is the earnest discussion of the fundamental concepts on which it rests; especially seeing that the origin of the movement which issued in the organization of the present congress—and which gave rise to the phrase "criminal anthropology"—was an extremely one-sided and in many respects extravagant and unscientific one.

This year's congress did not make much progress in settling fundamental questions—such as the real definition of criminality from a psychological point of view, or the classification of criminal classes, or the nature of moral insanity, all of which are necessary preliminaries to the more practical problems of treatment, etc.—but spent its time in sharp, sometimes violent, discussions between the school of criminal anthropologists in Italy, led by Lombroso and Ferri, and the party of doubters who have as yet little to offer in its place. Among the more serious and important papers I may mention: V. Hamel, *L'Anarchisme*; Dallemagne, *Dégénérescence et criminalité*; Tarde, *La Criminalité professionnelle*; Ballet, *Les Persécutés processifs*; Naecke, *La Psychiatrie criminelle*; Legrain, *Conséquences sociales de l'alcoolisme des ascendants*; and Mr. Francis Galton's report on his "finger-print" method of identification.

The next session of this congress is to be held in the Hague, on invitation of the Dutch Government, in 1901.

It is in line with the criticism made above—to the effect that this congress is not sufficiently severe in its devotion to the pure science of the criminal—to suggest that the psychologists of the other congress should give more attention to what is called *criminal psychology*. The psychology of abnormal types of mind has been greatly advanced in recent years, especially in France; and this advance has extended to a great many phases of mental defect. But the particular line of defect which criminology has in view has not been much treated by professed psychologists, although the first determination of criminology—as to whether

crime is in its nature really a mental defect at all—is of course a psychological one. I do not wish to disparage the anthropological investigations of the Italian school as far as they have been made with due severity of method—as some of them have not—but, allowing that much has been done and that much more will be done by the investigation of the physical side, it still remains true that the closer approach to the real criminal must be from the psychological side. Suppose, for example, we should admit the results of Lombroso, Ferri, and the rest, and say that there are certain physical "stigmates," or signs, which are found more often singly or together in law-breakers than in any law-abiding group of people, still two very important questions would have to be asked and answered before we should have the first start toward a real science of the criminal as such. First, What proportion of *people who are potential criminals do not become law-breakers?*—and, second, *What proportion of the law-breakers are not criminals?* The first question asks us to decide what type of mind is a potential criminal, or what degree of abnormity, social obliquity, etc., a man must have to be a criminal. This calls for a psychological definition of criminality. The second question takes us in exactly the same direction; for to ask how many law-breakers are not criminals is to admit that there are degrees of abnormal defect which the law takes cognizance of simply because more appropriate agencies do not. There are men and women in the jails who ought to be in reformatories, and others in the reformatories who ought to be in the asylums. This, then, calls upon us for a psychological determination of the lower limit of criminality—the limit below which we are dealing with the insane and the irresponsible—as the former question calls for the upper limit, that which sets bounds to the class of criminals who are never caught by the law at all. Both of these are accordingly psychological questions; and the main value of the results of the so-called criminal anthropology, as so far worked up, is to set these problems clearly in the light, especially the latter one. To establish moral atavism for one class of men, and degeneracy for another class, and criminal heredity in this fashion or that, is to throw these classes out of the really criminal class altogether, as far as any psychological definition which is now in sight would seem to indicate.

It is mentioned as a characteristic of Japanese artists that they will not repeat identical elements. They, in fact, understand the difference between the meanings of the terms "likewise" and "also," and they will have none of the latter. Accordingly, of fifty stencils of theirs recently published in an art work, there is not one which in all respects reproduces another, although there are many which resemble one another.

THE SO-CALLED CALIFORNIA "DIGGERS."

By MABEL L. MILLER.

TWO years ago I began to collect notes bearing on the settlements, manners, and customs of Indian tribes once inhabiting the country along the banks of the Sacramento and Feather Rivers, from the American River, north to Chico Creek and eastward into the Sierra Nevada Mountains. These tribes have been considered the lowest type of California Indians; but by force of changed environment the few remaining are giving up their wild ways and adopting civilization, even Christianity. They have always been misunderstood and often misjudged: the very name "Digger," by which these Indians are known, is a misnomer and a term of reproach, which they have always resented. It is of uncertain origin. Old settlers say that they did not hear the name until some time after the year 1841, when it was first used by an abandoned type of white men in allusion to the Indian custom of digging camass root for food. Immigrants became familiar with the name, and the appellation soon spread. Without doubt the name originated in the Rocky Mountains; there might have been a band or village of the Shoshones, or of some kindred tribe, that bore a name so closely resembling the word "digger" as to be easily corrupted into it.

White people scarcely ever pronounce Indian names correctly. The miners and immigrants of early days spoke of the Nem-Sā-Win Indians as the Nimshews; the Sulam-Sā-Wins as the Sulamshews; and the Kem-Sā-Wins as the Kimshews. There are mining camps designated after each of these clans or villages, but named in the miner's dialect. The inappropriate name of "Digger," therefore, is not a tribal name. No tribal name has ever been found, although the Ethnological Bureau at Washington has sent men here to study the language and character of these Indians; these men gave them the name of *Midu*, which they understood to mean man, but this is not a tribal name.

There is no tribal name, because there is no tribe. One of the first things that strikes the observer is the fact of the entire separation of these Indians into local units or villages, each bearing its own name and having its own chief. On this point we have the evidence of General John Bidwell, of Chico, who came to California in the year 1841; he has figured largely in the history of the northern part of the State, and has had large experience among these Indians. I have also met other old settlers, companions of such men as Kit Carson, Joe Walker, Pegleg Smith, and Isaac Graham, all men with whom Indian life and experience and the names of Indian tribes were subjects of constant

mention and use. They do not believe that these Indians had tribal names, tribal chiefs, or organizations.

These Indians, then, were greatly scattered in villages. Many of these villages spoke the same language, and in this case the group might be said to form a tribe. For instance, one dialect was spoken by the Indians on the east side of the Sacramento Valley, from the American River on the south to Chico Creek on the north, and eastward to the summit of, or perhaps in some places beyond the summit of, the Sierra Nevada Mountains, thus covering a territory of about ninety by fifty miles. From 1840 to 1850 there were from eighty to one hundred villages on that side of the Sacramento Valley, and an Indian population of seven or eight thousand. Yet, though the area and population were large, they had no tribal name, as far as any of the old settlers could ever learn, nor have I been able to trace one in my own researches with Indians belonging to that tribe; I therefore conclude that there was an entire absence of any tribal feature other than language, and that we have here an unconscious, unborn tribe, possibly on the verge of conscious tribal union.

As for the villages, many of them bore the name of the creek on or near which they were situated: for example, Nem-Sa-Win (Nem meaning "good," and Sawin "stream") was the Indian name for Butte Creek, Sulam-Sa-Win for Chico Creek, and Tem-Sa-Win and Kem-Sa-Win for other creeks. An Indian village was situated on each of these streams, and bore the name of the stream.

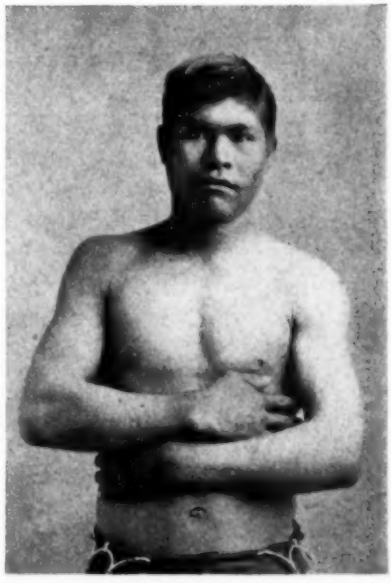
The majority of the old Indian villages were inhabited between the years 1840 and 1860, and probably a few as late as 1865 or 1870. Most of these villages, it will be seen, had a population of from one to four hundred, excepting *Colus*, which, according to General Bidwell, had, as late as the year 1845, a population of a thousand or twelve hundred, and which would seem to have been a sort of capital city for the Sacramento Valley Indians. Upon the site of this old rancheria is located the present town of Colusa, which took its name from the Colus village. Many instances of this change of population are to be found throughout the State of California. Thus in the particular region above referred to are to be found the towns of Yuba City, Butte City, and Princeton, all built upon the sites of former rancherias. The city of Marysville, situated not far from the above-named towns, is located between two very old Indian villages, and the town limits even now are impinging upon one of them.

The Indians of this region were dependent upon the streams for existence, their villages being found only upon the banks of the Sacramento River and its tributaries. There were good fishing and hunting along these streams while the fertile soil of the

valley yielded a heavy growth of wild grains, and the oaks here as elsewhere in California gave their contribution of acorns. It is of historical interest to note that the younger of the rancherias are those farthest from the main rivers, for the reason that, as the white population came in, the Indians retreated to the foothills. These Indians decreased and disappeared rapidly after the white people began to crowd them out of their possessions.

A period of fifty years has seen these villages completely depopulated and almost every trace of them destroyed. Towns and grain fields cover the spots where they once stood.

We can not imagine or realize what the taking away of their free life meant to the Indians. It was the one act of ours which they could understand, and it is no wonder that a feeling of suspicion and hostility arose among them which has only been overcome within the last few years. Because of this suspicion it must have been impossible a few years ago to obtain correct information bearing on their old life; but the feeling, if not forgotten, is at least fast fading from their minds, and many Indians can be found who will talk freely and sensibly of the days before the white man came among them. These tribes were but little inclined to war. At the time of the outbreak with the Modoc Indians, they exposed their fear by crowding about the white people, saying, "That kind bad Indian," "Me no that kind," etc. Although they did commit many desperate and awful deeds, these were done secretly, never openly and daringly; they were the easiest tribe in the State to bring into submission.



FULL-BLOODED YOUNG INDIAN FROM FEATHER RIVER, ABOUT TWENTY-SEVEN YEARS OLD.

The average "Digger" was of medium height and weight; a few were short and heavy set, but none were tall and thin. They had low foreheads, flat noses, large ears and mouths, and high cheek bones. Many of them had almost black complexions, while others seemed to be sallow or copper-colored. A few had very thin mustaches, or a few hairs here and there on the chin which might have been called a beard; the majority, however, were smooth faced. Both the men and the *mahalas*, as the women were called, had very heavy hair; old age did not thin it or turn

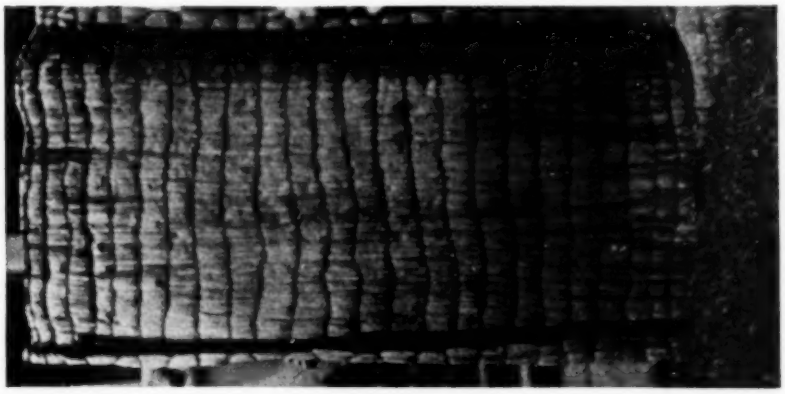
it gray to any extent. A bald-headed Indian would have been looked upon as a phenomenon.

I saw two Indians last summer whose ages were given by their people as one hundred and twenty and one hundred and thirty years. Old settlers who have known of them for fifty years do not think the figures are much exaggerated. The wrinkles in their faces were so deep that the skin fell in folds, and their bodies seemed to have shrunken to one half their former size. They were deaf, dumb, blind, bent, and helpless, yet their hair was barely streaked with gray, and so thick that a comb of ordinary size could not be passed through it.

A "DIGGER" MAHALA FROM FEATHER RIVER, FULL-BLOODED, AND OF FINER PHYSIQUE THAN THE AVERAGE.

The manners and customs of these Indians differed but little from village to village. During the summer months they needed only a shade to protect them from the hot sun. The wild, free life in which they reveled at this time of the year needed only food, but as winter drew near they had to build something which would protect them from the severe storms. An excavation several feet deep, and varying in diameter, was made first. Around the edge of this, willow poles or small trees were placed upright in the ground and drawn together at the top until a cone-shaped structure was formed. Bushes and strips of bark were then woven closely about this; lastly, dirt was thrown on and packed solid to the depth of six or eight inches. Only two openings were left—a round one at the top for the escape of smoke, and a square one close to the ground on the side most sheltered from the wind, which was used for a door; this opening was made just large enough for the occupants to crawl through. Furs and strips of matting woven from tule grass were used to sleep on. A fire was kept burning day and night in the middle of the "campoodie" (*Kahm-Poo-Dy*), the Indian name for these houses.

They were usually occupied by a large family, and must have been warm, but close and smoky. In the Sierra Nevada Mountains a heavy fall of snow would change them into white pyramids. A village of two or three dozen campoodies with blue smoke curling from their tops, and a bright morning sun reflected



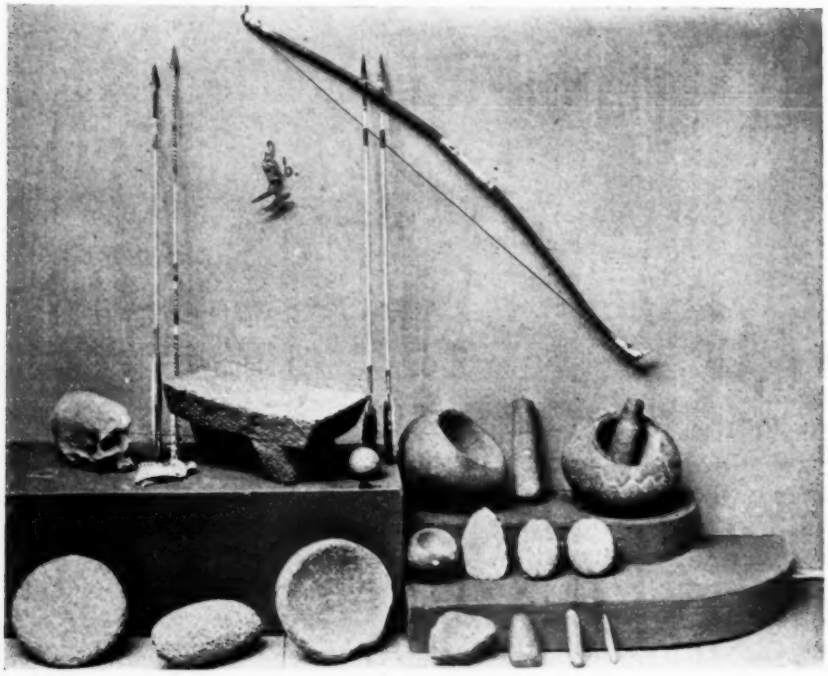
MAT OF TULE AND CEDAR-ROOT BARK, FORMERLY USED FOR BEDS, DOORS, ETC.

in thousands of sparkling crystals in the snow about them, made a scene which I have heard many old settlers speak of as beautiful.

Through the summer the Indians prepared their winter's store, which consisted mainly of dried acorns, used in place of flour or meal; berries, grasshoppers, grass seeds, fish, nuts, meats, and roots of various kinds. The camass (*Camassa esculenta*) was the principal root; it grew in abundance all over California, and is still plentiful in many valleys in the northern part of the State. It is about the size of the little finger, shaped like a sweet potato, and with much of the same flavor. A long, hard winter would cause these Indians to suffer more or less from privation. While in conversation with an old Indian he said: "Long time ago, 'fore white man come, big winter come, Indian no have enough to eat, lots of Indians die; my *mahala*, my little boy die."

Mortars, baskets, and flat rocks were their principal utensils for cooking. The mortars were made from rocks of various sizes, generally somewhat rounded but never uniform. The deep round hole in the center was ground with sharp, rough rocks. It was a slow process and required patience, for it took many days of work to complete one large mortar. These mortars were not only used for cooking but also for grinding food, when a round stone pestle would be required. No household was complete without the large, flat rock, which was generally stationary, and contained a half dozen or more round holes, varying in depth and diameter, used exclusively for grinding, and often surrounded by busy groups of *mahalas*.

Their greatest manufacture was that of baskets; they made hundreds of them yearly, of all shapes and sizes. The larger ones were woven from long, slender willows, the smaller from delicate strips of the willow bark. Some were decorated with beads and feathers, in others indescribable designs were worked with colored



"DIGGER" IMPLEMENTS, FROM THE COLLECTION OF DR. JEWETT, OF MARYSVILLE.

barks. The baskets that were made for cooking purposes were water-tight. Meats, soup, and so forth, were boiled in them by dropping in hot stones, replaced by others as fast as they cooled. Mortars were also used in this way, as the direct heat of fire was apt to break them. For frying meat, hot flat rocks were used. Large cone-shaped baskets were made to transfer household effects, gather food, and in general to carry. They were bound on the back, fastened by a belt about the waist and by a band from the top of the basket around the forehead.

The *mahala* was invariably the burden-bearer: these great baskets, loaded with all they could hold, were never strapped to the back of the man; he carried only his bow and arrow. Their method of starting a fire was most skillful. Two round pieces of hard wood were used, one tapered to a point at one end. These were rubbed together between the hands until the friction produced a spark, which, thrown into a heap of fine, dry bark, produced fire almost instantly. I wondered how it could be done

without burning the hands, so I hired an old Indian to satisfy my curiosity. He started a fire for me, and it was done so quickly, easily, and ingeniously that I was still left wondering.

During the warm months these Indians wore little or no clothing; the men sometimes tied a small girdle around their hips which was woven from grasses; oftener they went entirely naked. The women were never seen entirely nude. They wore a short skirt or apron, also woven from grasses, which, separated on both sides, reached to their knees in front and behind. Children of both sexes went naked, but when a girl reached the age of maturity she put on her grass skirt. Their winter clothing was made from skins.

Earrings of bone and wood, beads of berries, shell ornaments, and feathers arranged in many fashions for the head were their adornments. The bows and arrows used by this tribe differed very little from those carried by other Indians. The arrowheads were made mostly from flint, bone, and obsidian, though some schist was used. There are large ledges of flint and obsidian in the northern part of the State, and this material was widely distributed among the different tribes by trade.

Not every Indian could make an arrowhead, for it required a skillful workman. The process of manufacture was as follows:

"DIGGER" IMPLEMENTS, FROM THE COLLECTION OF DR. JEWETT, OF MARYSVILLE.

The material for the arrowhead was heated to a certain temperature, when it was chipped as desired with a spikelike stone implement, which was dipped in cold water, placed quickly upon the hot flint, and the necessary stroke given. The drop of water coming in contact with the hot flint and the simultaneous stroke cut the chip off about as desired. A rough stone was used to grind the points and edges into shape. Another weapon was the spear, which was made of hard wood, often five feet in length,

and tipped, like the arrows, with flint or obsidian. These heads were from three to nine inches long and from one to four inches in width. The points of these spears, as also the arrowheads, were sometimes poisoned by dipping them into liquid made from a poisonous plant or by the drippings from a putrid deer's liver. The Indian was a sure shot at close range with his bow and arrow. He had many ingenious ways of decoying his game. Sometimes a hunter would disguise himself with the skin and horns of a deer, and in a stooping position crouch about the alkali spots where the deer were in the habit of coming to "lick" until he was close enough to the animal to be sure of his shot, when a flint-tipped arrow just behind the left shoulder was as sure as any bullet. A deer, unless frightened, never jumps anything of any height; it will walk around a very small log. The Indians discovered this trait, and used it to their advantage. They would stretch a buckskin line across a trail that deer were frequenting, and station themselves in ambush at each end. The deer would walk up to the line, pause to sniff at it a moment, then follow it to the end, and generally to his death.

The white man did not teach the Indian to gamble; it was born in him. Men, women, and children were slaves to its fascination. They had all kinds of queer games, in which furs, beads, and any property, in fact, that they might possess could be exchanged in a manner that would do credit to white people. The men often wagered their *mahalas* against a few furs or bows and arrows, and in such cases loss or gain would not seriously affect the commercial standing of the parties involved.

In regard to matters of morality, the general statement may be made that these Indians did not have any set punishments for what they regarded as crimes; the criminal was, however, ostracized by them. Polygamy was practiced to a large extent among them; one man often had two or three wives, and a chief sometimes more. Virtue was not held precious by the women, but the men had regard for it in so far as their own families were concerned. When an Indian had more than one wife he hired each to watch the other. They had no marriage ceremony; when an Indian made up his mind that he wanted a *mahala* for his wife, he went to her home and asked the father for her; if there was no objection he was asked to eat with them, after which he had the right to take his bride away whenever he wanted to. If the girl opposed her suitor she was given one chance of escape—she ran a race with him. She was allowed a certain number of feet the start when the signal was given to run. If she won she was free, but if he caught her she had to go with him without a murmur.

The following story on this point was told to me by a civilized Indian woman:

Her grandmother was a great belle and had many suitors. There was one whom she hated but was forced to marry because he could pay the highest price for her. He was the chief of a village and had great possessions, but he was middle-aged and lame, while Napana was young, strong, and beautiful.

He had asked her father and been invited to eat, and, having turned over the stipulated price, Napana was his. In this case the price was so large that the bride was even denied her chance of winning freedom by the accustomed race. When Captain Lofonso came to take Napana away she refused to go and he had to carry her. Before he reached his home his strength gave out and he was obliged to stop for rest.

PAPOOSE IN HIS GEBELLE MADE OF TULE AND SOFT TANNED LEATHER.

An Indian woman never had the right to beg for her freedom, but she had the privilege of struggling for it. Napana's strength increased as she realized her unhappy situation, and she fought madly for freedom; for if she could escape from him and get back to her own home before she had entered his she would be free, and he would lose his wife as well as the price paid for her. Captain Lofonso lacked the strength to get Napana on his back again, but he was determined that she should not get away, for his lameness would deprive him of all hope of catching her. Night came on, and still he held her tight by both wrists, while her strong jerks and pushes swayed both bodies back and forth until they sank to the ground exhausted. Toward morning his strength failed and he fell asleep. As she felt his hands loosen their hold on her wrists she mustered all her remaining strength and crawled back toward her home; but she never reached it. Just as the sun rose over the mountain above her home she sank insensible at the threshold. Here Lofonso found her and bore her back to his home with never an opposing struggle.

Childbirth was of no inconvenience to the average Indian

mother; a few hours after delivery she was attending to her usual duties, even though it happened to be a walk of many miles. An acquaintance of mine had employed the same *mahala* for several months to do the washing for her family. It finally became evident that she was about to become a mother. She had the washing well started one Monday morning when she said: "Me feel heap bad, me go home; me think papoose come." Early the next morning she came back; the baby had been born and she was ready to finish the washing.

"DIGGER" BOY OF ABOUT TEN, FROM FEATHER RIVER.

The male child was held in greater favor than the female; frequently a child of the latter sex was destroyed as soon as born.

These Indians, though seemingly strong and vigorous, succumbed easily to disease; consumption and smallpox were the most prevalent and fatal diseases; much of the former was undoubtedly caused from their sweat dance, followed by the cold-water plunge. This dance was a festive event. The sweat-house was an immense cone-shaped structure, built near water, and much in the same way as their homes. All important events were celebrated with one of these dances, and Indians gathered from long distances to take part in them. A fire was built in the middle of the close, smoky house, and around it the naked, face-and-body-painted Indians danced. As the flames darted upward their enthusiasm increased until they leaped and shrieked in a frenzy of excitement. They kept this up until the perspiration poured from their bodies and exhaustion caused them to drop from the ring, when others would take their places, and they hurried to the stream to plunge into the ice-cold water. These dances were also used to cure disease, but more often caused death. The time for these dances, like the time for everything else, was reckoned by reference to the moon and by such natural periodical events as the ripening of various varieties of berries and the emigration of certain species of birds.

Once a year one of these sweat dances was followed by a burning of baskets, at which time the baskets that were not needed by the people of the village were heaped together and set on fire, the Indians dancing, laughing, and howling while the flames destroyed a good part of their year's work. It was a custom for which I have not been able to find their reason. "Indian have good time then," they say, when you inquire into the reason for this ceremony.

This tribe had their medicine men, whose treatment consisted in the use of herbs, magnetic motions, and rubbing, the sweat and cold plunge, and the sucking process—disagreeable enough, one would say, for the operating healer, when it is explained that he claimed to suck from the diseased part all malignant disease, and would spend consecutive hours in this loathsome practice of his art, spitting out of his mouth the poison drawn from the afflicted part.

This tribe of Indians were and are still exceedingly superstitious. If anything unusual took place in their village, such as a number of deaths closely following each other, every Indian would move camp; or, when one of their number met his death in some unknown way, they believed that the Bad Spirit was the cause and they could not leave the place quickly enough.

There is a beautiful fresh-water lake in the Sierra Nevada Mountains which years ago was a great fishing place for these Indians. One day a large party had gathered there to camp and to fish. It was near night when two young Indians fell from their canoe and were drowned without the others seeing them. They saw the empty canoe and the disturbed water, and one Indian saw a face which he declared to be that of the Bad Spirit. They fled from the place that night, not even stopping to search for the bodies of their companions. They have never fished there since, for they believe that if a drop of water from that lake could touch them they would die in the same way.

I was much interested in what we must call their religious belief as shown in their burial customs and the manner of mourning for their dead. Because they were savages shall we call it superstitious imagination? It is certain that they believed in a future life. They also believed in a Great Spirit as well as a good and a bad one, and had distinct personal conceptions of their gods. Thus they worshiped the sun because they believed the Great Spirit was making what they called the happy hunting ground there. After an Indian was dead and buried, if you asked his people where he had gone, they would point to the sun. It was their heaven. Before the white man came among these Indians they burned their dead. Whatever a dead man had owned was destroyed with him, that he might have it when he reached the

happy hunting ground. They believed that the smoke was the transferring agent between life here and there. When these Indians first saw the palefaces, as they called the white men, they thought them some of their dead returned to them in a new guise, and one that they by no means liked. After this time they began to bury their dead, explaining the change of custom by saying: "Indians go long way; no more smoke take 'em. Indians have to carry bow, arrows, skins, eberyting; take long time, no more want to come back."

The body was prepared for burial while still warm in the following manner: First, the knees were tied close to the chest and the head pressed down between them; the whole body was then compressed into as small and as round a form as possible, tied securely with buckskin string, wrapped in skins, and tied again. It was then buried in a large, round hole, the face turned upward, as were also the feet. The possessions were heaped upon the body and buried with it. After the Indians had begun to own horses and dogs, these were shot on the graves of their masters and their bodies left there.

This tribe now prepare their dead and bury them as nearly like the white people as possible, even neglecting to give them the accumulated property of this life.

Since obtaining the above information I have made a number of excavations in their old burial places and find that no particular position for placing the body could have been observed. The head sometimes faced the east, but just as often the west, and in several instances it faced upward and downward. These Indians did not make mounds, but selected soft soil for their graves. The bodies were buried from two to three feet deep; earth and sometimes stones were heaped up until something resembling a mound was formed. This, however, only depended upon the amount of work the living were willing to do for the dead.

They had many customs of mourning. The most interesting one was that adopted by a bereaved wife or mother. The hair of the mourner would be burned from the head, a sacrifice which meant as much to her as the laying away of bright colors means to us, and the ashes mixed with charcoal and pitch. With this mixture her cheeks, chin, and forehead would be streaked, and this emblem of mourning would be worn for many weeks. At the time of burial every Indian was expected to moan or howl, while many of them would writhe about on the ground and utter most unearthly shrieks. For a certain number of days after they had burned or buried their dead, the chief mourners would go to the grave a half hour before sunrise and, looking toward the spot where the sun was to appear, would express their sorrow in cries and moans until the golden rays fell about their world, when they

would go back to their homes, calmed and comforted—why, they alone know, but can not or will not tell. A half hour before sunset they repeated the visit, remaining until the sun dropped from sight, when the expression of their sorrow often rose to wild screams and shrieks which only exhaustion could calm, for they found no comfort until the sun rose again.

It is difficult to obtain information on what they believe to have been their origin. It is the one thing which they seem to hold sacred and do not care to talk about. One Indian smiled as he said: "Oh, all same as white man; Indians think lots of things 'bout that." However, the following traditions were told to me by one old Indian, and I afterward learned from a civilized Indian woman that they were what the majority of these Indians believe.

The first was that two big mountains, probably Mounts Shasta and Lassen, got mad one day a long time ago and threw up lots of dirt, all kinds of wild animals, one big chief, and two *mahalas*.

The second is best told in the Indian's own language:

"Long time ago, no Indians, no white man, no nothing; all water, one big lake. Sometimes little mountains, little trees, little grass, but no Indians. Lots of deer, lion, bear, wild cat, ebrything like that. Great Spirit come in big canoe, take good deer, good lion, good wild cat, good bear, make Indians; then tell these Indians kill all bad deer, bad lion, bad bear, bad wild cat—they all bad." There is a shadowy relation here to the Oriental idea of the transmigration of the soul, which the student of comparative religions may take for what it is worth.

There is no evidence whatever of any written language among this people. While there is much of legendary lore among them, it is entirely traditionary in its character. It is also pervaded to a great extent with a spirit of mysticism so as to render many of their legends almost unintelligible. The following tribal legend is a fair sample of their poetical stories. It is well known among the members of the tribe, and is related in substantially the same language by all:

A dead pine tree has stood many years in the deep, clear water of Homer Lake, which lies at the foot of Mount Keddie, in the Sierra Nevada Mountains. According to the old Indian tradition, it turns around once every year, when a great Water Spirit imprisoned in its base raises its head to take a look at the world. The legend says that when the Indians first came to the valley where the lake is situated they found it one great body of water. They came in canoes and lived for years on the tops of high mountains. The Water Spirit had full control and made them no end of trouble. One day they gathered in a body and made supplication to the Great Spirit, who answered by commanding the

Water Spirit to fill itself with water and make trip after trip over the mountains until it had emptied all the water into the ocean, after which it was imprisoned in the base of the tree, and the small lake left for its drinking water. It must remain there until the end of time. Only once each year, in January, is the spirit allowed to look out from its prison, and woe to the Indian who is unfortunate enough to be seen by this monster, which possesses a fascinating power that can not be resisted! The Indian is drawn down into the prison and devoured.

This is a crude legend, but many Indians still believe in its truth, and could not be hired to camp near or fish in Homer Lake.

This tribe is fast disappearing. The younger generations have intermarried to a large extent with other tribes, and in some instances with other races. Their enforced association with a superior race has also had the usual effect. These conditions, together with their total disregard of the ordinary rules of health, have brought about the usual result, and it is doubtful if more than one hundred and fifty Indians can be found to-day in the Sacramento Valley who are descendants of this once powerful tribe, and one tenth of this number would easily include those of pure blood.

In Plumas County, which lies in the mountain district and affords somewhat different conditions from the valley in the matter of climate and sparse white population, the proportion of survivors is very much larger, although the same conditions of intermarriage, etc., prevail here as well. It is a significant and perhaps hopeful fact that the population of this mountain region has been increasing within the last decade. Whether this be owing to intelligent appropriation of hygienic ideas gained from association with white people, or to the chance for a slower evolution, or whether it be the expiring flash of the candle in its socket, remains for further examination. It is apparent that they have made a successful effort to lift themselves from their low condition of savagery to a higher plane of civilization, as is instanced by their adopting proper clothing, living in more comfortable houses, using civilized food, and properly cooking the same. They also evince an inclination to Christian worship and education, but with rare exceptions the Indian seems incapable of acquiring a complex education. Reading, writing, and spelling are readily learned by them, and they particularly excel in the imitative studies, writing and drawing.

Whether on the whole these Indians will become civilized before the race becomes wholly extinct remains a problem which time alone will be able to solve.

INDIVIDUALISM *VERSUS* COLLECTIVISM.*

By the Right Hon. LEONARD COURTNEY, M. P.

BY the beginning of the present reign the study of political economy in this country had worked itself free from earlier errors, and it had come to be believed that the secret of social regeneration lay in the utmost allowance of freedom of action to every individual of the community, so far at least as that action affected himself, coupled with the most complete development of the principle of self-reliance, so as to bring home to every member, freed from legal restraint on his liberty of action, the moral responsibility of self-support and of discharging the duties, present and to come, of his special position. Such was the theory more or less openly expressed by economic thinkers when the British Association was founded, and the same theory lay at the base of Jevons's address in 1870. Can we hold it now or must it be recast? Since 1870 primary education has practically been made gratuitous. The legislature had an opportunity for abolishing the mischief of doles, but showed no inclination to make use of it, and there were even traces of a feeling of favor for the maintenance of these bequests of the past. The indiscriminate multiplication of so-called charitable institutions has in no way been reformed, and there is as great activity as ever in the zeal of those who would mitigate or relieve the effects of improvidence without touching improvidence itself. Codes of regulations have been framed for the supervision of the conduct of special industries, and their sphere has been extended so as to embrace at no distant period, if not now, the whole industrial community. The reformed Poor Law, which was regarded as a great step in the education of the workman, especially of the agricultural laborer, in independence, stands again upon its trial, and proposals are at least in the air for assuring to the aged poor a *minimum* measure of support without any regard to the circumstances of their past lives or to the inevitableness of their condition. The suggestions made by responsible statesmen have indeed been more limited and cautious, but it will be acknowledged of those, as of the German system, from which they may be said to be in some measure borrowed, that they involve a great departure from the ideal of individual development. Add to this that there is a movement, which has become practical in many large cities and towns, for the community itself to engross some forms of industrial activity and to undertake in respect of them to meet the wants of their inhabitants.

* From the presidential address before Section F, Economic Science and Statistics, of the British Association for the Advancement of Science.

All these developments and more may be summed up as illustrations of collectivity—an ideal which has its advocates and professors, and which looks in the future for regulated civic and national monopolies instead of unrestricted freedom of individual activity and for the supervision and control of those industries which may remain unabsorbed by state or town. In pursuit of this last conception there have been put forward not only requirements as to hours and conditions of labor, but a demand also for a living wage or a *minimum* below which no workman shall be paid; and this principle has been already adopted by some municipalities in respect of their monopolized industries. The state itself indeed has through the popular branch of the legislature declared more or less clearly in favor of the same principle in respect of the industries which are conducted in its service. We have not only to acknowledge the continued slowness of politicians to adopt and enforce the teaching of economists such as Jevons contemplated, but also the rise of another school of economic thought which competes for and in some measure successfully obtains the attention of the makers of laws. We must therefore inquire whether the failure of former teaching has not been due to errors in itself rather than to the indocility of those who have neglected it. The greatest difficulty which the teachers of the past have to overcome when put upon their self-defense lies in the suspicion, or more than suspicion, of an occupied multitude that their promises have failed. It is thought of them, if it is not openly said, that they had the ear of legislators for a generation, that the course and conduct of successive administrations were governed by their principles; and yet society, as we know it, presents much the same features, and the lifting up of the poor out of the mire is as much as ever a promise of the future. Some quicker method of introducing a new order is called for, and any scheme offering an assurance of it is welcomed. A ready answer can be given to much of the suspicion of failure that is entertained. That freedom of industrial action which is the first postulate of the economists has never been secured. The limitations and restrictions necessarily consequent upon the system of land laws established among us are not commonly understood, but although much has been done to liberate agriculture from their fetters its perfect freedom has not been attained. There may be free trade in the United Kingdom and free land in the United States, but the country is yet to be found in which both are realized, and even if both these requisites were attained the sores of social life would not be removed unless the spirit of self-reliance were fully developed. And how little has been done to secure this essential condition of progress! Nay, how much has been done by law and still more by usage to weaken and de-

stroy its power! The economist of the old school may boldly claim that so far as he has had a free hand his promises have been realized. There has been a larger population with increased means of subsistence and diminished necessity of toil, a people better housed, better fed, better clothed, with fewer relative failures of self-support; and if the teaching which has been partially adopted has brought about so much, everything it promised would have been secured had it been fully followed.

It will be conceded by the most fearless and thoroughgoing advocates of the liberty of individual development that it must be supported by large measures of co-operative action. The freedom and activity of association thus indicated are in no way inconsistent with the fullest theory of individual responsibility. A single workman may be powerless to induce his employer to modify in any particular the terms of his employment, but when workmen band together they may meet employers as equal powers. Such liberty of combination is a development and not a limitation of individual liberty. Another step is taken when the parties to such an arrangement as has been suggested seek to make its provisions compulsory on others, be they workmen or employers, who may enter into similar relations; and the principles of former economists would generally prompt them to condemn such attempts at compulsion. The Factory Acts were opposed in this way, although they rested upon different grounds; for, though in their consequences they affected the labor of adults, they were propounded for the defense of young persons and children unable to protect themselves or to be the parties to free contracts. Legislation has, however, been extended to control directly the employment of fully responsible persons, and this has been defended by three lines of argument. It is urged that, when the unchecked liberty of individuals destroys in fact the liberty of action of larger multitudes, it is in defense of liberty of action that those individuals are controlled. If a sea wall is necessary to prevent a large tract from being periodically inundated, it can not be permitted to the owner of a small patch along the coast to leave the wall unbuilt along his border, and thus threaten the lands of his neighbors with inundation. Again, it is urged that when the overwhelming majority of persons engaged in a particular industry, employers and employed, are agreed upon the necessity of certain rules to govern the industry, it is not merely a convenience, but is a fulfillment of their liberty, to clothe with the sanction of law the regulations upon which they are agreed. Lastly, it is submitted that there are individuals in whom the sense of responsibility is so weak, and whose development of forethought is so hopeless, that it is necessary the law should regulate their conduct as it may regulate the conduct of children. The

first plea appears to be sound in principle, though it may often have been applied to cases not properly coming within it. As to the second, the convenience of giving to an all but universal custom the force of law is incontestable, but it is at least doubtful whether this is sufficient to deprive individuals who deliberately wish to put themselves outside it of the liberty of doing so. Unless their action could be brought within the first line of argument, sufficient reason for restraint does not appear.

These limitations of individual liberty are familiar to us, and have obtained a firm hold in our legislation; but we enter upon comparatively new ground when we turn to the proposals that an increasing number of industries should be undertaken and directed by state or municipality, and that a *minimum* and not inadequate subsistence should be assured to all those engaged in such industries, if indeed the principle be not presently extended outside the monopolies so established. The ideas which are clothed in the phrases "the socialization of the instruments of industry" and "the guarantee of a *minimum* wage to all workmen" appear to involve a complete reorganization of society and an absolute abandonment of the theories of the past. This is not enough to justify their immediate rejection or their immediate acceptance. The past has not been so good that we can refuse to look at any proposals, however strange in appearance, offering a better promise for the future. It has not been so bad that we must abandon its methods in despair, as if no change could be for the worse, if not for the better. No one could now be found to deny the possibility, and few to question the utility, of the socialization of some services. The post office is in all civilized countries organized as a national institution, and the complaints that are sometimes heard as to defects in its administration never extend to a demand for its abolition. Some of our largest municipalities have undertaken the supply of water and of gas, or even of electric light, to the inhabitants, and a movement has begun, which seems likely to be extended, of undertaking the service of tramways. Demands have also been made for the municipalization or nationalization of the telephone service.

New considerations of great difficulty arise when we pass to the suggestion of the undertaking by local authorities of productive industries not in the nature of monopolies. In monopolies direct competition, often competition in any shape, is practically impossible; in other industries competition is a general rule; and it is by virtue of such competition that the members of the community do in the long run obtain their wants supplied in the most economical manner. When commodities are easily carried without serious deterioration, the constantly changing conditions of production and of transport induce a constant variation in the

sources of cheapest supply—that is, of supply under conditions of least toil and effort—and any arrest of this mobility involves a corresponding setback in the advancement of the economic condition of mankind. It is a necessary consequence of this process that the local production of special commodities should be subject to diminution and extinction, and that the labors hitherto engaged in such local production should become gradually worthless. There would be a danger of pressure to do away with invasive competition—action which would be destructive of the most powerful cause of improvement in the condition of the people. The position thus taken may be illustrated by an experience to which I have elsewhere referred, but so pregnant with suggestion that I need not apologize for recalling it. My native county, Cornwall, was in my boyhood the scene of widespread activity in copper and tin mining. There had not been wanting warnings that the competition of richer deposits in far countries would put an end to these industries in the county, but the warnings had not been realized and remained unheeded. In the years that have since passed they have been gradually and almost completely fulfilled. The mines were abandoned one by one, and the population of the county has steadily diminished in every recent census. What would the experience have been had the mines been a county or national property worked by county or nation? Can one think that the same process would have been maintained had the collective owner worked the mines directly, and the workingmen looked to county or nation for the continuance of work and wages? However much we may contemplate the reconstruction of an industrial system, it must, if it is to be a living social organism, be constantly responsive to the ever-changing conditions of growth; some parts must wax while others wane, extending here and contracting there, and manifesting at every moment those phenomena of vigor and decline which characterize life. In the development of industry new and easier ways are constantly being invented of doing old things; places are being discovered better suited for old industries than those to which resort had been made; there is a continuous supersession of the worth of known processes and of the utility of old forms of work involving a supersession, or at least a transfer, of the labor hitherto devoted to them. All these things compel a perpetual shifting of seats of industry and of the settlements of man, and no organization can be entertained as practicable which does not lend itself to those necessities. They are the prerequisites of a diminution of the toil of humanity. As I have said before, the theory of individual liberty, however guarded, afforded a working plan; society could and did march under it. The scheme of collective action gives no such promise of practicability; it seems to lack the provision of

the forces which should bring about that movement upon which growth depends. The economist of the past generation still holds his ground, and our best hope lies in the fuller acceptance of his ideas. The economist, however, must feel, if he is to animate multitudes and inspire legislatures, that he, too, has a religion. Beneath the calmness of his analysis must be felt the throb of humanity. Slow in any case must be the secular progress of any branch of the human family; but if we take our stand upon facts, if our eyes are open to distinguish illusions from truth, if we are animated by the single purpose of subordinating our investigations and our actions to the lifting up of the standard of living, we may possess our souls in patience, waiting upon the promise of the future.

POSSESSION AND MEDIUMSHIP.

By Prof. WILLIAM ROMAINE NEWBOLD.

ALL the phenomena of which I have been treating in my past papers can be grouped under the three conceptions of suggestibility, automatism, and subconscious mental states. Suggestibility, in its narrowest sense, denotes an increased tendency on the part of certain mental states to work out their own proper results, without interference from other states, and especially without interference from that innermost essence of our sense of self which we call our will. It applies, therefore, primarily to states existing within the range of the individual's consciousness. The suggestible individual, when he can remember or describe his condition, usually feels his will or self in abeyance, and describes himself as the victim of a power which he can not resist. His body obeys commands which he himself is unwilling to obey; ideas and beliefs possess his consciousness which he himself is unable to expel, even though he recognizes their absurdity; hallucinations of all the senses obtrude themselves upon him, or portions of his conscious realm are withdrawn from him in a manner which he can not but ascribe to the workings of some force foreign to himself. When this sense of opposition is lacking, it is because the suggestion meets with no opposition on the part of his accredited beliefs and instincts, and thus merely augments the stream of his normal consciousness without his discovering its extraneous origin.

Suggested hallucinations and ideas do not differ in any respect from spontaneous hallucinations and automatic ideas, save that the source of the former is apparent and that of the latter is not. In the fields of sensation and ideation, therefore, the conceptions of suggestibility and automatism practically coincide. The case

of motor automatism is somewhat different. Suggested movements are controlled through the agency of ideas, the ideas being directly suggested and the movements springing from them. But in automatic movements the patient is not conscious of any ideas controlling his movements; they seem to him to spring from some source outside himself. Some of these movements may plausibly be ascribed to purely physiological causes; others seem to require the assumption of realms of mind dissevered from the normal consciousness of the patient. If this view be correct, these forms of automatism also would fall under the conception of suggestibility, for they also would spring from mental states, although those states would not lie within the range of the patient's consciousness.

We may further conjecture that some of the hallucinations and automatic ideas, which rush cometlike into the patient's consciousness from nowhere in particular, had, in fact, an actual being in the subconscious realm before becoming parts of the upper system; but, from the nature of the case, it is never possible to verify the conjecture beyond a peradventure.

The words suggestibility and automatism, then, do not so much designate distinct classes of phenomena as the same phenomena viewed from slightly different points, while the conception of the subconscious is an inference based upon the relations which we know to exist between mental states and certain complex movements of the body. All these phenomena belong together; they can not be separated in theory, and they constantly occur together in practice; in short, they form a distinct natural family by themselves.

It is only within the last few years that they have attracted the attention of professed psychologists, yet we can not suppose that they never existed before. Even a superficial acquaintance with the literature of occultism, present and past, is sufficient to convince one that they have existed from time immemorial, that they have provided in the past the basis for many of man's most cherished convictions, precisely as in the present they constitute the chief content of our modern "spiritualism."

To get the least insight into these phenomena one must at the outset disabuse one's self of the pseudo-scientific notion that they are due to the "power of the imagination." It represents a rough attempt to get at the truth, but, like many another half truth, does more harm than good. We must clearly grasp the conception that man's mind is in many respects like his body. Like his body, it is the scene of constant struggle and rivalry between competing activities—it might not be far amiss to call them forces—in the ebb and flow of which his being consists. As disease germs occasionally succeed in effecting lodgment in his body and flour-

ish, in spite of the agencies that strive to effect their destruction, so thought germs occasionally take root in his mind, sprout and grow in spite of all that "he himself" can do to prevent it. Where are they to be found? In all that we can see, hear, or think, everything carries with it some suggestive power. Usually the trivial suggestions of the environment pass by unnoticed, but occasionally, under some special circumstances or in some sensitive temperaments, they take root. A friend of mine told me that he was talking with his wife one evening of a recent murder, and, as he talked, his eyes rested on her eyes for a moment longer than usual. He saw her shrink and turn pale, but paid little attention to it at the moment. A little later he fancied she still looked troubled, and tried to comfort her, but she would have none of it; she could not allow him to come near her. She kept thinking of his killing her and was afraid of him. She did not *believe* it at all; she knew how absurd it was as well as he did, but, she said, the moment he allowed his gaze to rest on her while speaking of that horrible subject, she *saw* him killing her, and could not shake the thought off. It wore off in the course of half an hour or so. An isolated suggestion of this kind very seldom gets lodged in a sound mind. The most common source of contagion is to be found in the beliefs of the community in which one lives. We are by nature social animals, and our aptness for social life is largely due to our sensitiveness to the collective suggestions of the social environment. An individual who proves refractory to such influences, and evolves along his own lines without reference to the claims or the standards of his age, soon lands either in Bedlam or the lockup. All the forces which we vaguely call evolutionary have for ages been impressing this trait upon man, and consequently we find it a potent factor in the production of automatisms of all kinds. A suggestible patient often responds to such impressions almost as mechanically as a mirror, and faithfully reflects the opinions and prejudices of his human environment without feeling his voluntary self to be in the least concerned in it. The cases of Mr. B—— and of Mr. Le Baron, which I gave in my August paper, are illustrations in point. Automatisms of this sort are always popularly ascribed to the intervention of some intelligence distinct from that of the patient, but the further definition of the intelligence varies in different ages and countries.

I shall pass over the familiar convulsive epidemics of flagellation, of dancing, of tarantism, the "holy jerks" of the great revival in the Southern States at the opening of this century, the convulsionaries of Saint-Médard, etc. All these have been often described, and I shall assume that my readers are acquainted with them. I shall, however, take a few cases from various periods of

the world's history, described by persons of different convictions and in each case differently interpreted, and shall try to show the absolute identity of type in each. The first occurred in France in 1636 in a Roman Catholic community, the second in England a generation later; both were ascribed to evil spirits. The third occurred in China only a few years ago, and was ascribed to the agency of a native goddess. The fourth and fifth are recent cases, one from Switzerland and one from British Columbia; both occurred among Spiritists, and were believed to be due to the spirits of deceased human beings, although one should note that in the last case the patient was not himself for a moment misled as to the true character of the phenomena. In all, the automatic processes manifested themselves, partly by hallucinations of sight and hearing, partly in compulsory ideas and emotions, and partly by more or less significant automatic movements. In all there also appears to be a tendency toward association and systematization of the automatic processes with one another, so that what begins by being a more or less confused medley, in some cases rising to the point of mania, finally becomes a tolerably coherent expression of a characteristic personality which in turn represents the notions entertained by the patient and the community in which he lives as to what the demon, god, or spirit ought to do and say. Especially should one note how the automatic processes invariably present themselves to the patient as being something absolutely foreign to himself—a trait which Prof. James happily hit off in terming such attacks "invasions."

The story of the "Devils of Loudun" has often been told. In 1631 an epidemic of "possession" broke out among the nuns in a convent at Loudun, in southern France, and was ascribed by the sufferers to the machinations of a priest named Urbain Grandier. Grandier, by his dissolute life and overbearing conduct, had made himself many bitter and powerful enemies, chief among whom was Mignon, the father confessor of the convent, and there is good reason for believing that, originally at least, the "epidemic" was nothing more than a conspiracy devised by Father Mignon and the Mother Superior for the destruction of Grandier. It was most successful. Grandier was accused of witchcraft, and, although he escaped several times through technicalities, he was finally tried by a tribunal appointed by Cardinal Richelieu, was condemned, tortured, and burned.

Shortly after his death one of the priests who were trying to exorcise the devils from the nuns, Father Surin by name, claimed to be himself possessed by the devils and has left a vivid account of his experience. He seems to have been a feeble and credulous old man, and whatever the origin of the "epidemic" may have been I am inclined to regard his experience as a genuine invasion

of the normal self by a mass of well co-ordinated ideas suggested by the shrieks and antics of the possessed. It finds an almost perfect parallel in the experience of Mr. R. L. Stevenson, which I narrated in my last paper.

In a letter to a friend, Father Surin says*: "Matters have come to such a pass that God has permitted, on account of my sins I suppose, something which has perhaps never before been seen in the Church. During the exercise of my ministry the devil passes from the body of the person possessed and, entering into mine, throws me down, convulses me, visibly passes through me, keeping possession of me many hours as a demoniac. . . . I do not know how to express to you what then takes place within me; and how that spirit *unites with mine* without depriving me either of consciousness or of my soul's freedom, yet acting all the while *like another self*, and as if I had two souls, of which the one is deprived of its body and of the use of its organs, and stands aside looking on the one that has got in. . . . The two spirits struggle in the same field, that is my body, and the soul is as it were divided. One part of it is the subject of diabolic impressions; another, of the motions which are proper to it, or which God gives it. . . . I feel that the cries which spring from my lips come equally from these two souls, and I can scarcely discriminate whether it is joy [*allégresse*] that gives rise to them or the extreme excitement [*fureur*] that fills me. . . . While my body rolls on the ground and the ministers of the Church talk to me as to a devil and heap maledictions upon me, I can not tell you what joy then fills me, *having become a devil*, not by rebellion against God, but by the misfortune which simply but clearly portrays to me the state to which sin has brought me. . . . My condition is such that I have few free actions; when I wish to speak, *my speech is arrested;* at mass *I am stopped short;* at table I can not raise food to my mouth; at confession I suddenly forget my sins, and I feel the devil come and go within me as in his own house. . . . As soon as I wake he is there, at my prayers; he takes away my thought when he pleases, when my heart begins to open to God he fills it with rage, he puts me to sleep when I wish to be awake, and openly, by the mouths of the possessed, he boasts that he is my master."

A parallel case is given by Henry More, the Cambridge Platonist, in his Appendix (page 58) to the second edition of Joseph Glanvil's book, "*Saducismus Triumphatus*, or, Full and Plain Evidence concerning Witches and Apparitions," London, 1682. It is entitled, "*A story of the marvelous condition of one* Robert Churchman *of* Balsham, *some six or seven Miles off from*

* Gauthier. Histoire du Somnambulisme, vol. ii, pp. 164 *et seq.* Italics as there given.

Cambridge, *when he was inveigled in* Quakerism, *how strangely he was possessed by a* Spirit *that spoke within him, and used his Organs in despight of him, while he was in his Fits. And how he was recovered from his Error, and regained to the Church by the devotions and diligence of Dr.* J. Templar, *still Minister of that place, as it is set down in his Letter to a friend, which is as follows.*"

Dr. Templar relates that he found the Quakers "very busie in enticing my people to a compliance with their perswasions in Religion," and among those influenced was this Robert Churchman. While Churchman was still in doubt the wife of a Quaker came to his house to visit his wife, but was refused admittance. "After some Parley the *Quaker's* Wife spake unto him in these words, *Thou wilt not believe except thou see a Sign, and thou mayest see some such.* Within a few nights after *Robert Churchman* had a violent storm upon the Room where he lay, when it was very calm in all other parts of the Town, and a Voice within him, as he was in bed, spake to him, and bad him, *Sing praises, sing praises,* telling him, that he should see the glory of the *New Jerusalem,* about which time a *glimmering light* appeared all about the Room. Toward the morning the *Voice* commanded him to go out of his Bed naked with his Wife and Children. They all standing upon the Floar, the *Spirit* making use of his Tongue, bid them to lye down and put their Mouths in the dust, which they did accordingly. It likewise commanded him to go and call his Brother and Sister, that they might see the *New Jerusalem,* to whom he went naked about half a Mile." This lasted three or four hours, during which "the drift of what was spoken was to perswade him to comply with the *Quakers,*" and afterward "he came to himself and was able to give a perfect account of what had befallen him." The spirit returned several times, but finally, after Dr. Templar had prayed with him daily for some time, he was left "perfectly free from all molestation. The *Quakers* hearing of his condition gave it out, that the Power of God would come upon him again, and that the wound was but skinned over by the Priest. Which made me the more importunate with him to keep close to the publick Service of God and to have nothing to do with them or their Writings. Which direction he followed till *November,* 1661, and then perusing one of their Books, a little after upon the tenth day of that Month, his troubles returned. A voice within him began to speak to him after the former manner. . . . The design which he discerned that it did aim at was to take him off from coming to the Church (where he had been that day) and from hearing the Word of God." This continued several days, but he was "very peremptory in his resisting of it. When it began to sollicite him he

replyed, That he saw it was a *Spirit* of delusion, which he would not obey. Upon which the *Spirit* denounced a Curse against him in these words, *Go ye cursed into everlasting Fire!* and so left him with a very great heat in his body. After this, he was in his own apprehension in a very comfortable condition, and while he was considering what had happened a Voice within him spake to him saying, That the Spirit which was before upon him was a Spirit of delusion, but now the true Spirit of God was come into him." It then gave him instruction in religious matters, contradicting what the former voice had said. Several times it came, and as Robert Churchman still doubted whether it were a good spirit or no it promised him what sign he would. Upon that he desired it to turn into brass a certain candlestick. "Presently there was a very unsavoury smell in the Room, like that of the Snuff of a Candle newly put out; but nothing else was done towards the fulfilling of the Promise. Upon the Lord's day following, he, being at Church, it came upon him. When the Chapters were named he turned to them in his Bible, but was not able to read. When the Psalm was sung, he could not pronounce a syllable. Upon Monday morning his Speech was wholly taken from him. When I came to him, and asked him how it was with him, he moved his head towards me but was not able to speak; I waited an Hour or two in the Room, hoping that his Speech might have returned unto him, and that I might have gained from him some account of his condition. But finding no alteration, I desired those who were present to joyn with me in Prayer. As we were Praying, his Body with much violence was thrown out of Bed, and then with great vehemence he called to me to hold my Tongue. When Prayer was done, his Tongue was bound as before, till at last he broke out into these words, *Thine is the Kingdom, Thine is the Kingdom;* which he repeated, I believe, above an hundred times. Sometimes he was forced into extream laughter, sometimes into singing; his hands were usually imployed in beating his Breast. All of us who stood by could discern unusual heavings in his body. This distemper did continue towards the morning of the next day, and then the voice within him signified to him that it would leave him, bidding him to get upon his knees in order to that end, which he did, and then presently he had a perfect command of himself. When I came to him he gave me a sober account of all the passages of the day before, having a distinct remembrance of what the Spirit forced him to do, and what was spoken to him by those who stood by. In particular he told me, he was compelled to give me that disturbance in prayer, which I before mentioned, the *Spirit* using his Limbs and Tongue as it pleased, contrary to the inclination of his own mind." Finally, Robert Churchman was "released from

all his trouble" through the diligent prayers of Dr. Templar, with the happy result that both he and his wife and "some others who were too much byassed with the Principles of the *Quakers*" acquired "a perfect dislike of that way."

Demon possession is at the present time common in China, and a number of curious cases have been collected and published recently by a missionary who has had forty years' experience among the Chinese.* Most of his narratives are in the third person, but one is given in the patient's own words. His name was Kwo, and he is described as a "hardy mountaineer, thirty-eight years of age, bright and entertaining, with nothing in his appearance which could be regarded as unhealthy or abnormal." His account is as follows:†

"Near the close of year before last (1877) I bought a number of pictures, including one of Wang Mu-niang, the wife of Yu-hwang [the chief divinity of China]. For the goddess Wang Mu-niang I selected the most honorable position in the house; the others I pasted on the walls here and there as ornaments. On the second day of the first month I proposed worshiping the goddess, but my wife objected. The next night a spirit came, apparently in a dream, and said to me: 'I am Wang Mu-niang of Yuin-men san [the name of a neighboring mountain]. I have taken up my abode in your house.' It said this repeatedly. I had awakened, and was conscious of the presence of the spirit. I knew it was a *shie-kwei* (evil spirit), and as such I resisted it, and cursed it, saying, 'I will have nothing to do with you.' This my wife heard, and begged to know what it meant, and I told her. After this all was quiet and I was not disturbed for some days. About a week afterward a feeling of uneasiness and restlessness came over me which I could not control. At night I went to bed as usual, but grew more and more restless. At last, seized by an irresistible impulse, I arose from my bed and went straight to a gambler's den in Kao-kia, where I lost at once sixteen thousand cash [sixteen dollars, a large sum for a peasant Chinaman]. I started for home and lost my way. But when it grew light I got back to my house. At that time I was conscious of what I was doing and saying, but I did things mechanically, and soon forgot what I had said." In this condition he remained for some days, the prey of irresistible impulses, which soon took a homicidal turn, and culminated in maniacal outbursts, alternating with epileptiform attacks. He was chained in bed, and for five or six days raved wildly. "My friends were in great distress. They proposed giving me more medicine, but the demon, speaking through me, replied, 'Any amount of

---

* Demon Possession and Allied Themes. By Rev. John L. Nevius, D. D. Dr. Nevius is convinced that these phenomena are really produced by demons.

† *Op. cit.*, p. 22.

medicine will be of no use.' My mother then asked, 'If medicine is of no use, what shall we do?' The demon replied, 'Burn incense to me, and submit yourself to me, and all be well.' My parents promised to do this, and knelt down and worshiped the demon, begging it to torment me no longer. Thus the matter was arranged, I all the time remaining in a state of unconsciousness." After more prayers and worship Kwo recovered consciousness, and was told what promises had been made in his name. He at once refused to worship the demon, upon which he was attacked again. Finally, he consented, and for some time the demon gave him little trouble, coming only at intervals, and then behaving very well. It promised to heal diseases, but "many diseases were not under its control, and it seemed as if it could perfectly cure only such as were inflicted by spirits"—in other words, those that were due to suggestion and could be relieved in the same way.

In the summer of 1878 a native missionary named Leng heard of Kwo, and persuaded him to tear down the shrine of the goddess and become a Christian, assuring him that if he did so he would be freed from the spirit's power. This he did, and a few days later his child died, which his wife ascribed to the vengeance of the goddess. Then the demon returned once more and said: "If your husband is determined to be a Christian, this is no place for me. But I wish to tell you that I had nothing to do with the death of your child." "What do you know of Jesus Christ?" they asked. The answer was: "Jesus Christ is the great Lord over all; and now I am going away, and you will not see me again." And the demon was as good as his word.

Prof. Forel, of Zurich, has given an account * of a case of this sort which seems to have puzzled him considerably. The patient, K. K., was a German, a wagon-maker by trade, had lived in the United States for some years, and had got interested in "spiritualism." Several times he tried to get the spirits to write by his own hand without success, but at last the hand started suddenly and wrote against his will. The writing was followed by automatic ideas in the form of the inner voice. All the communications professed to emanate from a spirit who, although unknown to him, was interested in him, and desired to improve him and prepare him for the life to come. Its commands were usually simple and reasonable enough. For example, the patient had been an excessive smoker, but at the spirit's command he gave up smoking entirely, and without especial suffering. Sometimes, however, the spirit was whimsical and even malicious. It forced him to smash lamps, break his false teeth, and do other things which caused him no little annoyance. The spirit always claimed that

* Zeitschrift für Hypnotismus, Jahrgang 1894–'95.

these irrational and disagreeable things were imposed upon him to test his obedience or to punish him for his sins. He was entirely unable to resist them. This patient gave himself into custody at an insane asylum at Burgholzi, in Switzerland, and was cured by suggestion in one hypnotic sitting.

It is not surprising that phenomena of this kind are common among spiritists. It would seem that the most favorable condition for the development of automatism would be a state of passivity on the part of the patient or "medium," in which he simply watches the impulses and thoughts that arise within him without attempting to repress any of them. Now, this condition finds its ideal fulfillment in the "developing *séance*" of the spiritist. A group of credulous folk gather in the dusk or darkness, and sing invocations to the spirits whom they believe to be hovering above them and watching for an opportunity to "impress" them. Their sole practical principle is "not to resist the spirits," and consequently the least tendency to spontaneous automatism is fostered and allowed to develop to the utmost. Furthermore, its development is favored by the complex suggestions of the environment and by the direct exhortations of believers. I remember one such "developing *séance*" which I attended some years ago, at which a stout woman rose and delivered an "inspirational" address, purporting to proceed from the spirit of a Methodist minister who had recently died in the neighborhood. As soon as it was concluded she fell heavily on the floor in hysterical convulsions. Three or four excited women at once ran to her, crying, "Don't resist, dear," "Let him take possession of you," "He won't hurt you, don't be afraid," etc., while the victim struggled and moaned: "Oh, I can't, I can't let him! Take him away!" In a few minutes another woman began to speak in the name of the spirit supposed to be controlling the first "medium," and immediately the struggles of the latter ceased. At that time I knew little of these phenomena, and the incident puzzled me a good deal. I never supposed, of course, that it was due to spirits, but I did not see any way of ascribing it to fraud either. With the exception of myself, all present were ardent "spiritualists," and I had every reason to believe them sincere in their efforts to reach the other world. It was not a paid sitting, and most of those present were personal friends of one another. From my present point of view it seems intelligible enough, and is quite analogous to that last described.

But t e best case of this kind that I have yet seen described is that of Mr. Charles H. Tout, of which he has himself written a very acute analysis.* He had become interested in these ques-

* Proceedings of the Society for Psychical Research, vol. xi, pp. 302–316.

tions and took part in some sittings at which no professional mediums were present. Almost from the outset two ladies of the circle were affected with spasmodic twitchings of the fingers and arms. "Sometimes these movements were very violent, causing them to slap and thump the table with such force as to seriously bruise their fingers and hands. . . . With the exception of these two ladies, none of the sitters were much affected on these occasions, though at times an almost irresistible impulse came upon myself to imitate their actions; but though I occasionally allowed the impulse, at the suggestion of the other sitters, to have full play, it never with me took the bit between its teeth and got beyond my control. I could always stop at once any movements in my limbs, or change the attitude of my mind, by an effort of will." At a later sitting a dream-personality similar to that of Mr. Stevenson developed itself. "I seemed to have, as it were, stepped aside, and some other intelligence was now controlling my organism. I was merely a passive spectator interested in what was being done. My second self seemed to be a mother overflowing with feelings of maternal love and solicitude for some one. The very features of my face seemed to be changing, and I was distinctly conscious of assuming the look of a fond and devoted mother looking down upon her child. I even inwardly smiled as I thought how ridiculous I must be looking, but I made no effort to resist the impulse. I now felt I wanted to caress and console somebody, and the impulse was strong upon me to take my friend in my arms and soothe and cheer him. I resisted the impulse for some time, but finally yielded to it. In doing so I had a distinct feeling of relationship to my friend. After a little while I began to be myself again." At another time a lady who was supposed to be sensitive to spirit influences believed that she got for Mr. Tout a message from the spirit of his father who had died of bronchitis and pleurisy some twenty years before. The hymn, "Nearer, my God, to Thee," which had been a favorite with Mr. Tout's father, had just been sung. With practice Mr. Tout seems to have become more suggestible. On another occasion, he says, "I was affected to an unusual degree, experiencing violent twitchings in my limbs, and sensations of painful chilliness that made my teeth chatter again. I sat, as I always did now, passively waiting for what might transpire. All sorts of impulses seemed to be moving me, and I noticed how susceptible I was becoming to the slightest even half-realized suggestion offered by the course of my own thoughts or by the chance remarks made by the other sitters. I presently felt myself being drawn, as it seemed to me, toward the floor on the left side of my chair. I yielded to the influence and fell prostrate out of my chair on to the floor with considerable force, and, though the others thought I must have hurt

myself, I certainly felt no inconvenience from the fall. I lay groaning for a little while, and then got up and sat in my chair again.

"Some one now suggested that we should sing, and this being done, I immediately became affected by the music, which moved me in a very extraordinary manner. I fancied myself realizing the whole scene clearly. In a great cathedral I seemed to be the presiding priest at the close of a great function pronouncing the benediction." He then went through several of these dreamlike states, some of which he describes, and says of them: "In all these phases or states I seemed to be two individuals—one my ordinary, critical, observant self, closely watching what took place in and around me, the other the character that seemed to be personating itself through me." Toward the close of the *séance* the hymn "Nearer, my God, to Thee" was sung. "Before the first verse was finished I began to experience strange sensations. . . . I seemed to be far away in space. . . . I seemed to be moving or rather to be drawn downward, and presently felt that I had reached this earth again; but all was strange and fearful and lonely, and I seemed to be disappointed that I could not attain the object of this long and lonely journey. . . . At this point some one said, 'It's his father controlling him.' I then seemed to realize who I was and whom I was seeking. I began to be distressed in my lungs. . . . I was in a measure still conscious of my actions, though not of my surroundings, and I have a clear memory of seeing myself in the character of my dying father lying in the bed and the room in which he died. It was a most curious sensation. I saw his shrunken hands and face and lived again through his dying moments; only now I was both myself—in some indistinct sort of way—and my father with his feeling and appearance."

Mr. Tout then shows in detail that these dreams—for they are no more—sprang from the suggestions which were given him by his friends and from autosuggestions furnished by his own mind. For example, the journey through space sprang from a ghost story which he had once read, told from a ghost's point of view, and describing the return of a restless spirit to earth. He then adds: "I know myself and my susceptibility, even under normal conditions, to suggestion in all sorts of forms, not necessarily verbal, so well that no alternative remains to me but to believe that what I did was due simply to everyday suggestion in one form and another. Building and peopling *châteaux en Espagne* was a favorite occupation of mine in my earlier days, and this long-practiced faculty is doubtless a potent factor in all my characterizations, and doubtless also in those of many another full-fledged 'medium.'" With this sane and rational conclusion all sensible folk will agree.

IDIOTS SAVANTS.

By FREDERICK PETERSON, M. D.,
CHIEF OF CLINIC, DEPARTMENT OF NERVOUS AND MENTAL DISEASES, VANDERBILT CLINIC, COLLEGE OF PHYSICIANS AND SURGEONS.

THE term *idiots savants* is applied to all such idiots, imbeciles, or feeble-minded as exhibit special aptitudes of one kind or another, always out of proportion to their intellectual development in other directions, and often remarkable as compared with similar accomplishments or faculties in normal individuals.

There are many cases of the kind recorded in literature, and it is not at all uncommon to hear of idiots in our newspapers and museums who are exhibited as musical prodigies, "calculating boys," and the like. Beyond the fact of the existence of such curiosities, and the record of their deeds, there has been little or nothing written in explanation of these phenomena. The psychology of the condition is exceedingly obscure, and even were the physiological processes which underlie special aptitudes understood, there would still remain the mystery of the manifestation of particular talents or faculties in minds otherwise blank or defective. It is the aim of this brief paper rather to present the nature of the facts which we have to consider, and to indicate lines of study that might be pursued with advantage, than to add any material knowledge to the psychology or ætiology of the condition.

In the first place, then, let us inquire concerning the kinds of aptitudes which may be developed to an unusual degree in mentally deficient individuals. The aptitudes may be summarized as follows:

Arithmetical faculty, musical faculty, special memories, imitative faculty, modeling faculty, delineative faculty, faculty for painting, aptitude for games (draughts, etc.), aptitude for buffoonery.

This is not a classification, but merely an arrangement for examination of the instances cited under each heading. Some of these captions really include others. Thus, special memories would cover usually the musical faculty. The imitative faculty should include possibly the repetition of musical airs and compositions, drawings and paintings from objects, as well as imitations of gestures and actions. Arithmetical faculty is a qualification which perhaps encompasses too much, since this aptitude in the mentally defective is generally restricted to calculation only. The term "musical faculty" also is to be understood in a limited sense, since the musical prodigies of this description rarely exhibit more than a phenomenal memory for musical compositions.

Under the heading of aptitude for buffoonery, I have thought proper to place such defectives as evince a talent for wit and humor of a low order, as is instanced in some of the historical court fools and buffoons.

After this short preface regarding the nature of the cases it is proposed to include in a description of *idiots savants*, examples of each kind will be cited under the appropriate caption.

ARITHMETICAL FACULTY.—Precocity and an extraordinary power of the faculty of mental arithmetic have been frequently noted in idiots.

Dr. Howe described an idiot with little use of language, yet with astonishing power of reckoning. If one's age were told him, he would give the number of minutes one had lived in a very short time.

Guggenbuehl observed an imbecile at Salzburg who would solve the most difficult problems in mental arithmetic with incredible rapidity. At one time the attempt was made to induce him to become a teacher of arithmetic, but as he could not understand his solutions of problems it was found impossible for him to explain them to others.

Atkinson noted an idiot woman with arithmetical faculty in excess whose only delight was to be occupied with questions of number.

Ireland mentions a boy at Earlswood with the arithmetical faculty. He could add and multiply three figures by three figures with lightning rapidity.

In a valuable study of Arithmetical Prodigies in the American Journal of Psychology (April, 1891), E. W. Scripture has collected thirteen examples of this aptitude. Six of these (Ampère, Gauss, Archbishop Whately, George Bidder, Safford, and Wallis) were men of eminence or genius who exhibited extraordinary precocity or aptitude in mathematics. The remaining seven cases are properly classified under the heading of this paper.

Tom Fuller, born in 1710, known as the Virginia calculator, was a native African, never knew how to read or write, but had phenomenal powers in arithmetic. Asked how many seconds in a year and a half, he responded in two minutes, 47,304,000. Asked how many seconds a man had lived who was 70 years 17 days 12 hours old, he answered in a minute and a half, 2,210,500,800.

Jedediah Buxton, an Englishman, born in 1702, was excessively stupid as a child, never learned to write his own name, had not even common intelligence in the ordinary matters of life, and whose mind never reached a development beyond that of a boy of ten years, was a marvelous mathematician.

Zerah Colburn, born in Vermont in 1804, was exhibited from the age of six as a mathematical prodigy. He was a backward

child and never able to exercise even ordinary intelligence in other directions or to learn much of anything. He had supernumerary digits on both hands and feet, and was a degenerate.

Vito Mangiamele, son of a Sicilian shepherd, born in 1827, was exhibited as a calculating boy, but was otherwise dull and ignorant.

Dase, a German, born in 1824, extremely stupid and dull in other directions, never able to master a word of any language but his own, was a mathematical genius. As an instance of his power, he multiplied correctly, in fifty-four seconds, 79,532,853 by 93,758,479.

Grandmange, a Frenchman, born without legs or arms in 1836, was another example of a mathematical prodigy.

Mondeux, a Frenchman, son of a woodcutter, born in 1826, possessed an extraordinary arithmetical faculty, although he could neither read, nor write, nor cipher. He could not remember a name or address. He solved this problem in a few seconds: How many quarts of water in a fountain from which a group of people draw as follows: The first person takes one hundred quarts and one thirteenth of the remainder; the second, two hundred quarts and one thirteenth of the remainder; the third, three hundred quarts and one thirteenth of the remainder; and so on until the fountain was emptied?

Dr. Heim cites the instance of a woman of very limited intelligence and deficient in language, who could give the number of minutes a person had lived as soon as the age was told her.

There are other examples in literature of mathematical aptitude in individuals otherwise defective, but these will suffice to illustrate the character of the cases under consideration. When we remember the deficiency of idiots in general as regards even the simplest kinds of calculations—such as counting, addition, subtraction, multiplication, and division—the contrast of powers in the exceptional instances mentioned becomes even more astonishing.

We may deduce from a study of such cases several facts which are noteworthy. First, the mathematical aptitude in idiocy is never of a high order. The faculty consists entirely of excessive powers in mental arithmetic—in simple calculation, which is a better term to apply to it. Secondly, it is instinctive and congenital. It is observed only in the congenital variety of idiots, imbeciles, and degenerates; and on careful examination we shall find anatomical and physiological as well as psychological stigmata of degeneration in such cases. Thirdly, much of the faculty is due to the increased power of visualization—to great development of certain parts of the sight centers. Most of us, in mental arithmetic, compute by means of visual images. We, who have

been educated to cipher, see the figures before us in computation. Individuals who have been made to employ objects—such as the fingers, grain, pebbles, or the abacus—visualize these objects in their mental arithmetic. Indeed, the derivation of the word calculation recalls the ancient use of pebbles in reckoning. A psychological analysis of the mental operations required in calculation is a difficult problem, the solution of which is very desirable. Scripture, in his study of arithmetical prodigies, concluded that the faculty of mental arithmetic, as exhibited in his illustrative cases, depended upon—1. Accurate memory for a sufficient length of time. 2. Velocity of memory. 3. Firmness with which long series of arithmetical associations cling together. 4. Mathematical inclination. 5. Visualization.

It will be noted that the fourth, the mathematical aptitude, is the obscure factor, which the author did not attempt to explain, and that the other four points are merely the means of expression of the mathematical inclination.

MUSICAL FACULTY.—The susceptibility of all classes of idiots to rhythmical sounds or noises has been frequently commented upon by various authors. Music is the most sensual and the least intellectual of the arts. A musical aptitude in certain idiots is therefore not so astonishing in some respects as the possession of the arithmetical faculty.

One of the most noted examples of *idiots savants* of this class was Blind Tom, a pure negro, born in Georgia, in 1849. Born blind, he showed intelligence only in regard to sound. He learned to repeat words early, though the words had no meaning to him. He could repeat whole conversations, but entirely without comprehension. His own spontaneous language was never much more than inarticulate sounds. He could imitate any sound about him. He could recite with ease anything heard in Greek, Latin, French, or German. It was a species of echolalia. He could play on the piano from memory any piece of music, no matter how intricate, after hearing it but once. He would imitate, note for note, the improvisations of another. He is said to have retained as many as five thousand musical compositions in his memory.

Seguin describes (Idiocy, page 405) a blind male idiot with a remarkable talent for piano-playing, with this same power of repeating anything after a single hearing.

Helat (*La Folie lucide*) tells of a congenitally blind female idiot with great musical talent. Her voice was correct, and when once she had heard a piece she knew the words and the music. This phenomenon excited so much attention that Géraldy, Liszt, and Meyerbeer visited her.

Dr. Paris (Lancet, February 11, 1888) records the case of an

idiot, aged fifteen, unable to pronounce a single word, incapable of receiving the most elementary education, able to hum correctly and gracefully a large number of airs, and who did so every day, always the same and always in the same order, without variation. While the family was fond of singing, the idiot had never heard any one sing except the father and mother.

A young woman whom I examined not long ago is an idiot of low grade, without ability to converse or care for herself, yet presenting a marvelous memory for music, reproducing, both by singing and on the piano, numerous musical compositions. Some intricate instrumental pieces she renders accurately with her voice in a high falsetto key. Several of her sisters are musicians.

Dagonet (*Traité des maladies mentales*) cites the case of an idiot girl who began to speak at the age of nine years, but was possessed of a very small vocabulary, and was ignorant of notes. She had a remarkable aptitude for music, and could repeat upon the piano compositions heard for the first time. She was the daughter of distinguished musicians.

Morel (*Études cliniques*) records the history of an idiot boy who, becoming possessed of a drum, made such rapid progress in its use in three or four attempts at playing that he was made drummer in the orchestra at the asylum where he lived. His father and grandfather had been drummers in the army, and a normal brother had always had the desire to follow the same pursuit.

In this class of *idiots savants* also it is to be noted that the idiocy is congenital. We observe, too, that the musical faculty, although well developed in contrast to the general intellectual paucity, is not of a high order. It consists of a remarkable auditory memory, together with the power of expression, by means of the vocal musculature or fingers, of the musical memories stored up in the brain. There is no spontaneous musical expression, no power of invention. An interesting feature is the evident hereditary character of the talent. In some of the instances cited the imitation of sounds heard is not restricted to music, but includes sounds of every kind.

SPECIAL MEMORIES.—Winslow records the case of a man who remembered the day of burial of every person who had died in the parish for thirty-five years, and who could repeat with perfect accuracy the names and ages of the deceased and of the mourners at the funeral. He was a profound idiot, and could not reply intelligibly to a single question beyond this, nor be trusted even to feed himself.

Morel cites the instance of an idiot who was unable to count twenty, yet could name all the saints of the calendar and the days of their respective *fêtes*.

In some of the books on these defectives is mentioned an idiot with a wonderful memory for English history. When supplied with the slightest cue, he recounted in measured tones whole passages of it.

Falret noted an imbecile who could give immediately the days of birth and death and the principal events in the life of any celebrated personage mentioned to him.

Such instances of elaboration of special memories where all other faculties are in abeyance might be multiplied. The cases above mentioned were, no doubt all of them, examples of extraordinary development of the auditory tracts and centers. There are other cases in which the visual memories are disproportionately developed, as in idiots with unusual memory for places or faces.* These patients, too, are congenital defectives.

IMITATIVE FACULTY.—Under this caption should probably be included some of those cited under other headings, for the repetition of sounds heard, or the delineation of things seen, or the copying of actions all partake of the nature of imitation. Imitation is an instinct in defectives as it is in normal persons. Sometimes it manifests itself in simple forms, such as echolalia or echokinesis; occasionally it is exhibited in a manner so remarkable as to constitute a true talent. An instance imparted to me by a friend is in point. It is that of a young man, congenitally imbecile, but with an astonishing power of imitation of sounds. The multiform notes and noises of birds and voices of every domestic animal, even the peculiar sounds of sawing and chopping wood, the creaking of wagons, and the like, are so perfectly reproduced by him that he is in demand as a partaker in social entertainments.

THE MODELING, DELINEATIVE, AND PAINTING FACULTIES.—Examples of *idiots savants* with talents bespeaking disproportionate development of the visual centers, together with the power of reproduction by modeling, drawing, or painting, are occasionally to be met with.

Ireland, in his work on idiocy, describes two cases—one with an aptitude for drawing and wood-carving, and another with a talent for the designing and construction of buildings.

There was a noted idiot at the Earlswood Asylum who made a perfect model of a ship—a vessel ready for the sea—with every block and rope in order, said to be a marvelous specimen of naval architecture. It took him four years to construct it. He was able to speak but a few words, and these imperfectly, and could not follow the meaning of sentences nor write; but he learned

* Thus Drobisch cites the case of an idiot boy whose visualization was so great that he could repeat word for word a page, even if in Latin, after a single reading.

to copy drawings, which were so excellent and curious as to be preserved in the palace. He had seen neither sea nor river nor ship, and had only a representation of a vessel in the middle of his handkerchief as a guide.

Sollier describes an imbecile girl of six years, unable to read or write or understand anything, yet gifted with the power to draw anything she saw. She copied perfectly all the letters of the alphabet without knowing their names or signification. She reproduced thus objects and also scenes of which she was witness, though she comprehended nothing about them.

Gottfried Mind was an imbecile who died in 1814. He was so skillful in the drawing and painting of cats that he achieved distinction and became known as the cat's Raphael. Many examples of his work are to be seen in European art galleries.

APTITUDE FOR GAMES.—Seguin cites the case of an idiot with extraordinary ability to play draughts, and there are one or two other instances of a similar kind on record. It is probable that such talent depends upon an unusual power of visualization, by which the necessary positions and moves are foreseen.

APTITUDE FOR BUFFOONERY.—It is not uncommon to meet among idiots, imbeciles, and feeble-minded cases with an aptitude for drollery, and for witty or humorous remarks and actions. Not infrequently it amounts to a true talent, and thus justifies including them among the *idiots savants*. At the present day the sayings and pranks of this class of defectives are seldom heard outside of institutions for their care, but there was a time in history when the quips and antics of the fools took the place of our comic papers of to-day. The dramas of Shakespeare have kept alive our knowledge of the fools of his day, for there are more than thirty of them who flaunt their weaknesses, folly, wisdom, and license through his plays. He depicts both natural and artificial fools, for these were the two classes of buffoons employed to amuse mediæval society. The origin of the custom, in England at least, seems to have been in the legal disposition of the persons and estates of idiots. They were given into the custody of the nobility and gentry, who profited sometimes by their estates, and, clothing them in the familiar livery, made them the butt of ridicule and practical jokes for the amusement of themselves and their guests and retainers. It is instructive and interesting to read in this connection Doran's History of Court Fools and Arnim's Nest of Ninnies. The latter book in particular throws light upon the nature of the custom of keeping domestic fools, and incidentally illuminates the civilization of the time. Here is Arnim's description of a court fool in the palace of the King of Scotland. He was a fat fool, a trifle over three feet high, two yards in circumference, at the age of forty years:

His head was small, his hayre long on the same;
One ear was bigger than the other farre;
His forehead full, his eyes shined like a flame,
His nose flat, and his beard small, yet grew square;
His lips but little, and his wit was lesse,
But wide of mouth, few teeth, I must confesse.

His middle thick, as I have said before;
Indifferent thighs and knees, but very short;
His legs be square, a foot long and no more;
Whose very presence made the king much sport.
And a pearl spoone he still wore in his cap,
To eat his meate he loved, and got by hap.

A pretty little foot, but a big hand,
On which he ever wore rings rich and good.
Backward well made as any in that land,
Though thick; and he did come of gentle blood.
But of his wisdom ye shall quickly heare
How this fat fool was made on everywhere.

This court fool could say bright things on occasion, but his main use to the ladies and lords of the palace was to serve as victim to practical jokes, cruel, coarse, and vulgar enough to be appreciated perhaps in the Bowery.

Any quick-witted imbecile or feeble-minded individual in those days had no difficulty in securing a good livelihood, and sometimes even prosperity and fame. Under such conditions it became common for normal individuals to adopt the calling of the jester or buffoon, and these were known as artificial fools.

CONCLUSIONS.—The aptitudes of various kinds described above as not infrequently encountered in idiots are all of rather low order. They are never found in any but the congenitally defective, who usually present the stigmata of degeneration. They consist chiefly of great powers of memory, visual or auditory, and of facility in imitation. There is no spontaneous invention. The *idiots savants* are mere copyists in music, modeling, designing, or painting; yet at the same time their talents stand out in strong contrast to their general feeble-mindedness. As a rule, the aptitudes are precociously developed, and are frequently lost before reaching adult life. The physical basis of such talents must be a precocious perfection of the cerebral organization in certain areas, together with a true hyperplasia of tissue in such regions and a tendency to early degeneration. There must be an increased number of cellular elements and sensori-motor combinations and associations in definite parts of the brain. Cases have been described in cerebral pathology of misplaced aggregations of such tissues in the brain under the name of heterotopia of gray matter, and it is possible that some such unequal distribution of the

structures underlying psychological processes will be found to account for the presence of the extraordinary talents of *idiots savants*. It is questionable whether Heinecken, the "child of Lübeck," should be included among any of the cases described here. He died too soon (at the age of four years) for the fact of mental weakness of any kind to be established; but his precocity made him the wonder of his time (1721–'25). He knew the chief incidents of the Pentateuch at the age of one year, had mastered all of sacred history at two years, and was intimately acquainted with modern and profane history and geography, and spoke French and Latin, besides his native tongue, at the age of three. Surely such precocity as this must have been due to extraordinary aggregations of gray matter in parts of the brain of a truly abnormal character.

IGNEOUS INTRUSIONS AND VOLCANOES.

By ISRAEL C. RUSSELL,
PROFESSOR OF GEOLOGY IN THE UNIVERSITY OF MICHIGAN.

MANY geologists have watched the action of volcanoes in eruption, and have gazed into their craters when in a state of mild activity. One of the most striking of the phenomena revealed at such times is that great volumes of steam are given off from the molten lava which rises in the craters. This steam either escapes quietly, as in the case of the Hawaiian volcanoes, or with explosive violence, as in eruptions of the Vesuvian type. It is now conceded by probably all students of volcanoes that the proximate cause of the violent explosions accompanying many volcanic eruptions is the sudden escape of highly heated steam. Most modern theories advanced to account for volcanic phenomena are based on the assumption that steam is the propelling force which causes the lava to rise from deeply seated sources and to be extruded at the surface. Steam contained in the molten lava is thought by Shaler and others to cause the molten rock to rise and overflow, in much the same way that carbonic acid generated in dough causes it to expand, or as the carbonic acid in ale makes it overflow when the cork of a bottle in which it is contained is withdrawn. In these theories, heat is considered as the prime source of energy, and that, given the heat, steam will be generated which will force the lava to the surface.

I do not wish to criticise the theories that have been advanced, or even to attempt to review them, but simply to change the point of view from which volcanoes have commonly been studied, in the hope that the phenomena observed will group themselves in another and perhaps more instructive way. Current theories are

based largely on what is seen when one looks down into the throat of a volcano in a state of mild activity; let us supplement such a view by endeavoring to form a conception of the conditions that exist far below the surface.

In many instances volcanoes are known to be situated on lines of fracture in the earth's crust. In all volcanoes it is evident that there is a passageway or conduit, leading from an intensely heated region within the earth, to the surface. These conduits must be several thousand feet in depth. Indeed, it is not unreasonable to assume that they may have a depth of several miles or possibly tens of miles. What one sees, therefore, in looking into a crater of an active volcano is the summit of a column of molten rock, the bottom of which is tens of thousands of feet below.

Judd has compared the mild activity of Stromboli to the boiling of mush in a tall vessel, the heat being applied at the bottom. Steam is generated in the mush, and, rising through it in bubbles, elevates the surface. When the bubbles of steam burst, portions of the viscid material are blown into the air. Such an analogy is certainly sustained by what is seen at the summit of a column of molten lava when we look into the crater of a volcano.

In seeking for information concerning the conditions that exist far below the surface, when a volcano is giving off steam at the top, we may obtain a few facts to guide us by studying the ruins of extinct volcanoes and the nature of igneous intrusions as laid bare by erosion.

Volcanic necks tell something of the conditions that exist within a volcanic mountain. In more deeply eroded volcanic districts one finds dikes and intruded sheets. These are connected, in reference to mode of origin, with Plutonic plugs, laccolites, and what I have termed subtuberant mountains.* These various forms taken by intruded rocks and surface extrusions, as I have attempted to show in the article just referred to, belong in a single genetically connected series. A break in the earth's crust which reaches a region of great heat may be injected with plastic rock and form a dike; if the fracture terminates above in a region of horizontally stratified beds, the magma rising through it may expand widely, at the same time lifting a broad cover to a comparatively small height—that is, form an intruded sheet; or be more restricted in its expansion, according to its degree of fusion, depth below the surface, and possibly other causes, and raise a cover of less diameter to a greater height—that is, form a laccolite; or, if a great volume of plastic material is intruded, give origin to a subtuberant mountain. Should the fissure reach

* On the Nature of Igneous Intrusions. In The Journal of Geology, Chicago, vol. iv, 1896, pp. 177–194.

the earth's surface, molten material may be forced through it and a volcanic eruption initiated. In brief, variations in one process may lead to the formation of dikes, sheets, laccolites, and other forms of intrusion, and to volcanic eruptions. Possibly all these results might follow from the opening of a single fissure.

In all the instances enumerated the magma may be the same, so also the source of the heat and the origin of the pressure which forces the molten rock into the earth's crust, or causes it to be discharged at the surface.

Returning to the hypothesis that steam is the mainspring of volcanic phenomena, it will be conceded, I think, by most observers that steam contained in a magma can not be called upon to account for its rise in a deeply seated fissure so as to form a dike, or, when the conditions are varied, give origin to laccolites, etc. Not only are the rocks composing such intrusions, the densest of igneous rocks, but they are without steam cavities. Besides the filling of a fissure with plastic or fluid rock, and still more strikingly in the production of other varieties of intrusions, a bulk of matter, measured in some instances by cubic miles, is forced in among the solid rocks of the earth's crust. There is thus a bodily transfer of matter, frequently for long distances, from one place to another deep within the earth's crust and against an enormous pressure. All these facts are adverse to the conception that bodies of liquid or plastic rock are moved by the expansive force of the steam contained in them. The energy expended in producing igneous intrusions is in numerous instances so far in excess of that manifest in any explosive volcanic eruption that has been recorded—not excepting Cosequina, Sumbawa, or Krakatoa, but rather combining them all and more in one—that it becomes of a different order of magnitude, and a different origin is to be suspected.

In the case of subterranean injections, it is evident that the source of the *heat* which renders the rocks plastic, and the source of the *pressure* which forces the plastic material into fissures, etc., are distinct and should be separately considered.

The heat manifest in both subterranean and surface igneous phenomena, as is well known, has been variously accounted for, but I do not wish to consider this problem at present. The consensus of opinion, however, seems to be that the heat referred to is mainly and essentially the internal heat of the earth—i. e., the residual heat of a cooling globe. It is conceded also that the matter composing the earth at a depth of a few miles below the surface is so highly heated that it would become plastic or even highly fluid if the pressure under which it exists were removed. The best conception we can frame of the general physical condition of the earth is, that it consists of a more or less spherical mass, which is highly heated and in a potentially plastic condition within, and

that inclosing this inner sphere is a comparatively thin shell of solid rocks—the passage from the hot and potentially plastic interior to the cold and rigid outer shell being gradual, one merging with the other by insensible gradations.

The crust of the earth rests on the sphere of plastic material within and exerts a pressure upon it. Contraction of the progressively cooling crust also causes pressure to be exerted on the inner sphere. If the pressure of the crust on the material it incloses were equal at all points, the inner mass, except for the effect of rotation, would be a perfect sphere. Variations in the pressure of the crust at different localities might result from several causes, such as unequal cooling in the crust itself, the transfer of material from the inner sphere into or to the surface of the crust, the shifting of material from one locality to another on the earth's surface, etc. Of these disturbing conditions I am inclined, provisionally at least, to ascribe the greatest potency to the effects of erosion, transportation, and sedimentation on the earth's surface, thus lightening certain areas and loading others.

If we conceive of the earth as a sphere without rotation, it is evident, from our present point of view, that it would remain a sphere only so long as the pressure of the crust on the material within was equal at all points. Local variations in the pressure of the crust would deform the inner sphere and result in a change in the shape of the earth. It is not to the general problems of *isostasy*, as formulated by Dutton, that I wish to direct attention, however, but rather to the results that might be expected to follow should the crust of the earth be broken.

A fracture in the earth's crust would establish a line of weakness, which, so far as the reaction of the crust on the interior is concerned, would be equivalent to a local relief of pressure. Should a fissure reach the highly heated interior, the rocks in its vicinity would become plastic and be pressed into the opening, and tend to widen it both by pressure and by the fusing of its walls. As the magma from a deep source rose in the fissure, the resistance to be overcome would be less and less, thus insuring greater plasticity, and, if it gained the surface, establishing conditions commonly recognized in volcanic eruptions.

Should the plastic rock fail to reach the surface, but cool in the fracture, a dike would be the result. If the fracture terminated above in a region of horizontal stratified rocks, lateral expansion of the magma rising in it might occur, and intruded sheets, laccolite, etc., be formed.

As to the origin of fractures we have but few facts to guide us. It is well known from the study of faults, dikes and volcanoes, that breaks, at least in the superficial portion of the earth's crust, have been of common occurrence. Whether any of these breaks

have extended through what we term the earth's crust is unknown, but the fact that fissures have in numerous instances become filled with fused rocks is evidence that the breaks referred to are sometimes of sufficient depth to reach regions of intense heat, and many facts seem to favor the idea that this highly heated region is the potentially plastic interior of the earth.

The principle that areas which become weighted by the shifting of material on the earth's surface subside, while unloaded areas rise, has been advocated by several American geologists, and is now common property. It has frequently been asked, however, why an area that is being unloaded should cease to rise so long as erosion continues, and becomes stable or even undergoes a reverse movement; and why an area that is having material added to it should cease to sink and be re-elevated.

In reference to the first of these questions the nature of igneous intrusions seems to furnish an answer. If the rise of a region of denudation is due to an injection of plastic material beneath it, in response to the resulting relief of pressure, the reservoir of highly heated rock forced from below into the cooler rocks above or a protuberance on the surface of the inner sphere will cool, and consequently become more and more rigid. When the intruded rock becomes solid, the portion of the earth's crust lightened by erosion will be increased in weight by material added from below. For the reason that the intruded magma tends to fuse the rocks with which it comes in contact, it will be welded to them as cooling progresses, and when solidification occurs the crust may have greater strength than before the intrusion. Each of these changes would tend to check the upward movement. Dikes and other forms of injections thus tend to strengthen the rocks into which they are forced in much the same way that fractures in the earth's crust are healed and the strata strengthened by the deposition of quartz and other minerals in them so as to form veins. In the case of subterranean injections the cooling of the reservoir of molten rock will be accompanied by contraction, which would cause a subsidence of the surface.

Stating the ideas that I have just attempted to convey more briefly, we should expect that the rise of a denuded area from the effect of internal pressure causing an influx of plastic material beneath it would be checked by the cooling and hardening of the injected material, and a reverse movement or subsidence of the surface initiated as the injected material contracted on cooling.

I am well aware that in these suggestions we are dealing with a single portion of a complex machine and that other results than those considered may follow. That the sole cause of the rise of an eroded area is not the injection of a molten magma beneath is apparent from the fact that such an injection would cause a rise

in temperature in the rocks above, and thus by expanding them increase their upward tendency. The subsequent cooling of these heated and possibly metamorphosed rocks would also tend to renewed subsidence of the surface. In other words, subterranean intrusions are accompanied by an abnormal rise of the isogeotherms and their loss of heat by a return to normal conditions.

In progressively loaded areas, as has been pointed out by Reade, Shaler, and others, there is a blanketing of the earth's heat and a rise of the isogeotherms; the accompanying expansion of the rocks tends to check subsidence and limit accumulation. The processes of erosion, transportation, and sedimentation in special areas are thus limited by conditions within the earth. Erosion favors elevation until the plastic material transferred to the region beneath the lightened area cools and hardens. A decrease in elevation due to contraction then ensues, and is accompanied by a decrease in erosion, which comes to an end when the land is reduced to base level. Loading favors sedimentation by causing subsidence until the thickened sediments become heated and by reason of their expansion elevate the surface to or above base level. There is a mutual interaction beneath the earth's crust also, since, if only one region of erosion and one of sedimentation are considered, the checking of elevation in a region of erosion by the cooling and hardening of injected magma beneath will give greater resistance to the flow of plastic material from beneath the region of sedimentation.

Deep erosion of subtuberant mountains should reveal a central area of igneous rock surrounded by a belt of metamorphosed rocks which on its outer border, in case the injection occurred in ordinary sedimentary strata, should pass into unaltered sandstone, shale, etc. In such an instance a radial section should reveal a gradation from igneous rock through metamorphosed rocks to unaltered sedimentary beds. The breadth of the central core of igneous rock would vary with the size of the intrusion, and, down to a certain limit at least, with the depth of the plane of erosion. One or more generations of dikes might occur in either the central area or in metamorphosed or sedimentary rocks surrounding it. Great intrusions if deeply eroded would thus present the conditions sometimes cited as examples of "regional metamorphism." Some of the features observed in the crystalline region of Canada seem to illustrate the surface features that would be found if a great subtuberant uplift should be pared away by erosion.

The fact that a large majority of volcanoes are situated near the sea has led to the supposition that sea water gaining access to highly heated rocks is the chief if not the essential cause of volcanic eruptions. The hypothesis, however, that the sea is the

source of the water which, converted into steam, takes such a conspicuous part in volcanic eruption is open to several objections.

In almost all land areas the rocks below the surface are saturated with water, the source of which is mainly rain. Excepting that the pressure of the sea on its floor tends to force water into the rocks beneath, there does not seem any good reason for concluding that the earth's crust where covered by the sea is more highly charged with water than the portions beneath land areas.

Another argument for the presence of sea water in volcanoes is that after eruption the country about a volcano is sometimes whitened for many miles with salt, and also that some of the vapors arising from volcanic vents are such as might be expected to occur if the substances contained in sea water were sufficiently heated. It is to be remembered, however, that large bodies of salt derived in some instances from the evaporation of sea water occur among stratified rocks, and also that many sedimentary deposits are saturated with saline water. It thus becomes evident that communication between the conduit of a volcano and the sea is not the only means by which saline water can come in contact with molten rocks.

It is well known that volcanoes as a rule are located near the borders of continents, or on the floor of the sea. This fact is more in harmony, however, with the idea proposed by Dana, that the margins of continents are determined by the location of weak belts in the earth's crust, along which maximum movement takes place, than that the presence of surface water bodies is essential to the existence of volcanoes. In support of this conclusion it may be pointed out that volcanoes of recent date occur in the Great Basin, hundreds of miles distant from the Pacific. The Great Basin is a region of faults, and as much a belt of weakness in the earth's crust as if it had chanced to be situated near the sea.

Owing to the increase of pressure with depth, it is evident that cavities in rocks in which any considerable bodies of water can be stored must become less and less frequent as the distance below the surface increases. As has been shown by Van Hise, at a depth in excess of about thirty thousand feet what may be termed appreciable cavities can not exist. Rocks under pressure become compact, so that deeply seated rocks must be less porous than similar material near the surface. These considerations lead to the conclusion that water-charged portions of the earth's crust are superficial. Hence the water given off by volcanoes in the form of steam, and probably also the gases produced by the dissociation of the elements composing water and the vaporization of the various salts it contains, must reach volcanic conduits in their upper portions. These considerations add strength to the conclu-

sion advanced on a previous page, that the primary force which causes lava to rise in the conduit of a volcano is not steam pressure.

How molten lava becomes charged with water can only be conjectured. It is well known that many liquids, especially when highly heated and under heavy pressure, will absorb gases. In a similar way we may conceive that liquid or plastic rock, on coming in contact with water, will absorb the steam produced.

When molten lava rising in the conduit of a volcano passes through water-charged rocks and nears the surface, pressure is relieved and the occluded steam escapes. This escape is either quiet or explosive, dependent on the nature of the magma in which the steam is dissolved. If the magma is highly fluid, as in the case of many basic lavas when extruded, the steam escapes quietly; but if the magma is viscous, as is the usual condition of acid lavas when erupted, violent explosions are apt to occur. The quantity of steam absorbed also influences the fusibility of a magma. Apparently the larger the quantity of occluded steam, the more liquid the molten rock becomes. Greater freedom may thus be afforded for the passage of a magma in the upper portion of the conduit through which it rises than obtains at lower levels. Something of the intermittent character of volcanic eruptions may depend on this cause. Probably, also, the quantity of water present in a magma has an influence on the nature of the minerals formed as it cools. For this reason one would expect differences to appear in the mineralogical composition of rocks formed from magma that have cooled near the surface, and those that failed to reach the water-charged portion of the earth's crust.

The intimate connection between subterranean injections and volcanoes leads to the suggestion that the domes above intruded magmas may become fractured and give origin to volcanoes which would be supplied by local reservoirs. Something like "craters of elevation" may be thus formed.

If two or more cisterns of molten rock should be formed in the earth's crust near each other, or at different levels near the same radius of the earth, and fractures formed above them which would admit of the escape of their material to the surface, the striking phenomena of two adjacent volcanoes erupting independently of each other might result. Such an occurrence is rendered more probable by the fact that reservoirs beneath subtuberant mountains are supplied through fissures from below, which might become closed, thus isolating bodies of injected material in the earth's crust. Even if the feeding fissures were not closed, the large cisterns of fused rock to which they lead might discharge some of their material without immediately affecting the plastic central mass of the earth, which in these sugges-

tions is considered the primary source from which injections are derived.

It has been thought by some who have speculated on the condition of the earth's interior that isolated reservoirs of fused rock exist in the generally cool earth's crust, due to unequal cooling; another origin for such lakes of lava may be postulated if we consider them as injected magmas not yet cooled.

A mental picture of the probable occurrences that give origin to subterranean intrusions and volcanoes, and account for many observed phenomena in this connection, may be sketched in outline as follows:

The earth is hot and potentially plastic within, and cold and rigid at the surface. Unequal cooling and the shifting of material on the surface are disturbing conditions that tend to change the shape of the plastic interior, and to crumple and break the crust. If a fissure forms in the lower surface of the crust, the potentially plastic material beneath will become plastic on account of the removal of resistance to pressure, and be forced into the break, and a dike be formed. Under certain conditions the plastic material rising in a fissure may expand between layers of stratified rock so as to form laccolites, subtuberant mountains, etc.

If a break extends entirely through the crust, molten material forced into it may reach the surface. As the molten lava rises in such a break, it passes through rocks that are more and more highly water-charged, the water is vaporized, or perhaps its elements are dissociated, and the vapors and gases formed are absorbed by the fluid rock. As the lava comes to the surface the steam and gases absorbed under great pressure escape and furnish some of the most striking phenomena of volcanic eruptions. Loss of heat as a magma nears the surface also favors the escape of occluded gases.

In this view of the nature of volcanoes it is evident that an arrest of pressure on the reservoirs from which they draw their lavas would stop their action. If a fissure extends through the earth's crust to the potentially plastic interior, it is difficult to see how an outflow of molten material would be checked unless the conduit should become closed. Under the vast pressure that exists at a depth of several miles it is impossible to comprehend how fissures can exist, but the plastic material beneath is under pressure of a similar order of magnitude, tending to force it out through any opening that may be formed. A near balance between the pressure tending to close a fissure and the pressure on the magma below tending to maintain a communication with the surface may therefore be conceived to exist; when the balance is in favor of extrusion volcanic eruptions follow, and when the reverse is the case the conduits become closed.

The evidence furnished by dikes and other intrusions, as well as by volcanoes, points to the conclusion that the magmas supplied to them are derived from deeply seated sources, but the fact that the material forming intrusions and the products of volcanoes differ widely among themselves has been cited as evidence that they could not have been derived from a common reservoir. This objection is based on the assumption that the highly heated material forming the earth's interior is homogeneous. It has been argued that, if the material within the surface shell was not homogeneous—excepting so far as density increases with pressure or is influenced by the increase of heat with depth—an adjustment would be established by the flow of matter from one locality to another. In reply, it may be said, however, that this conclusion is inconsistent with the idea of a solid but potentially plastic inner sphere. From the point of view assumed in this essay, it appears that what may be termed a local flow of the matter comprising the earth's interior would not occur unless there was a local relief or a local increase of pressure. The idea that the earth as a whole is a rigid body is in harmony with the conclusions of eminent physicists and astronomers, while the assumption of local plasticity due to local relief of pressure is consistent with the observed movements of elevation and depression familiar to geologists.

Returning to the consideration of the passage of the conduit of a volcano through the water-charged portion of the earth's crust, some of the phenomena displayed by dormant volcanoes may perhaps be explained. If the lava in the conduit of a volcano cools and hardens below the water-charged zone, the life of the volcano to which the conduit leads may be considered as ended. If the cooling takes place at the surface or within the water-charged layer, steam will continue to be generated below the obstruction, and, if means for its gradual escape are not furnished, will ultimately lead to an explosion which may blow away a volcanic mountain. In such an occurrence the main explosion would probably be preceded by a breaking of the rocks and possibly subterranean explosions which would bring temporary relief of pressure. The behavior of many dormant volcanoes and the earthquakes that frequently accompany a renewal of their activity might thus be explained.

When igneous intrusions enter the water-charged portion of the earth's crust but do not reach the surface, steam is also generated, and may assist such intruded magmas in opening passages for themselves and in elevating the domes that are raised above them. When an intruded magma meets a large body of subterranean water a violent explosion must result, which, when near the surface, would blow away the dome above, leaving a depression of the type of Coon Butte, Arizona, or Lonar Lake, India.

The suggestions offered in this paper are in harmony with the conclusion that many of the phenomena accompanying volcanic eruptions are due to the escape of steam occluded in molten lava, but are opposed to the hypothesis that the rise of lavas from deeply seated sources is due to the same cause. The source of the heat and the source of the pressure manifest when a magma rises through a volcanic conduit are considered to be distinct, and in the main of different origin.

NATURAL HISTORY IN THE PRIMARY SCHOOLS OF FRANCE.

By FANNY BIGNON.

DURING the last few years instruction in our primary schools has been undergoing an interesting evolution. The authorities have broken away from superannuated traditions, and have arranged courses of a wholly new character. There are no more long analyses, endless conjugations, and dictations of catchwords. While language, according to the tyrant of words and syllables, may be a loser by this change, I wish to show that science, and especially natural history, is a gainer.

The natural sciences have indeed had a place in the primary schools, and, in order to get his certificate of graduation, a child of eleven years was obliged to make a compilation on some such subject as the following:

1. Breathing. What happens to the air in the lungs? A part of this air combines *with the heat of the blood.* Results. (This topic was given at Brest in 1893.)

2. Digestion. Absorption of foods. Stomachic digestion. Intestinal digestion. (Hérault, 1893.)

3. What is an insect? Transformations of insects. (Haute-Garonne, 1894.)

4. A flower. Its composition. The rôle of pollen. Describe the ovary. (Hérault, 1893.)

5. The characteristics of lime. Its function in the soil. Means used to furnish lime to soils which lack it. (Meuse, 1893.)

From these examples it will be seen that all branches of natural history are touched upon, but physiology is treated more fully. We will not stop to criticise the method of putting the questions, and possibly some of the inaccuracies of statement may be laid to typographical errors. They are taken from a work by Messrs. Barreau and Bouchet, the former a supervisor at Paris, the latter a college principal.

But let us consider the methods used to give to our children

the extensive knowledge which is expected of them. They listen to lessons which the teacher imbibes ordinarily from a text-book designed for the special purpose of preparing candidates for the graduating examinations. In this new kind of Bible from which the teacher refreshes himself each day, physiology, zoölogy, botany, and geology are methodically arranged by layers or slices, of which a dose of four layers (irrespective of the thickness of the layer) must be absorbed per month. The scholar has a text-book which is a *résumé* of the teacher's, filled with indigestible prose, crowded with scientific terms, where classification follows classification. After learning so many Greek and Latin derivatives, will there be time to observe the dentition of an animal, to analyze a flower, or compare stones? No; the natural-history collections of our schools remain under lock and key; the teachers forget to use them, and the scholars to look at them. But the text-book must be learned. Does the teacher make his own drawings? Usually he contents himself with the more or less exact illustrations of the text-book. How could he possibly find time for drawing, when in one lesson he must describe the whole human skeleton and define rachitis, caries, ankylosis, dislocations, fractures, and sprains, and in another give pell-mell the characteristics of the *Chenopodiaceæ*, *Polygonaceæ*, *Euphorbiaceæ*, *Urticaceæ*, *Laurineæ*, *Juglandaceæ*, *Cupuliferæ*, *Salicineæ*, *Betulaceæ*, and *Plataneæ!*

Picture to yourself an audience of youthful Parisians who, for the most part, have never seen hemp except in cloth, or oak except in a chair or table, a prey to this discriminating instruction! Some of them go to sleep or lose themselves in reveries where natural history has no part; others refresh themselves with candy under their desk tops. And this is the best thing they could do. Just as insects, when placed in a deadly atmosphere, resist asphyxia by closing their stigmata and ceasing to breathe, so our children escape the harmful effects of our instruction by closing their eyes and ears. The result is threefold: On leaving the primary school they know nothing about natural history, but sometimes think they know considerable; secondly, this ill-directed study not only has not developed their habits of observation and their judgment, but has accustomed them to speak inaccurately and carelessly of things of which they have no knowledge; and, thirdly, most of these little *savants* hold science in great contempt.

Is this what the reformers in education expect? We do not believe it, and we think that they may rightly hope for something better if the instruction be given by the only method which is in harmony with the subject: that of observation and experimentation. Collections must be made not only of curiosities but of common things; there must be a garden where the seed may grow

and the flowers bloom; and there must be a collection of the common stones and rocks.

The teacher should prepare for his lesson by observation of the specimens which he is to show; the children should examine, describe, compare, and classify. They should not consider in one lesson all the apetalous families, but should learn to know the gilliflower, the violet, the blossom of the oak, all which they may gather for themselves. They may perhaps be ignorant of diseases of the bone and the operations they require, but they will know the furnishings of a cat's mouth and the peculiarities of the rabbit's, and what distinguishes them both from ours. At the end of the year they will have a very small burden of natural history, but they will have acquired good habits of mind, their intellectual faculties will be developed, and, what is even more important, they will love science and will have a taste for learning. The habit of observation will be exercised out of school hours, and even after they have graduated they will experience an increased pleasure in their walks which will react upon their physical and moral health.—*Translated from the Bulletin de la Société Zoologique de France, tome 20.*

THE BORDER LAND OF TRAMPDOM.

By C. W. NOBLE.

LAST summer it was my fortune to spend the vacation on a unique trip through Michigan. My chum and I went down to Berrien Springs to try our hand selling books, but a week of this kind of life sufficed to show us that the rapid road to fortune did not lie here, as the advertisements would lead us to believe, and we abandoned books, bag, and baggage and joined the great army of men "on the road." Our outfit was very simple. We bought a coil of steel wire, a pair of pliers, and a wooden frame to bend the wire over to make tidy-holders. This was our means of support. Besides this we had a small satchel containing an extra shirt apiece, two clean collars, and other things which we might otherwise find necessary to buy on the way. When we traveled we commonly shipped our goods by freight to some point about a week in advance on our route and then made our way there as best we could, supporting ourselves *en route* by selling our tidy-holders. On these occasions we varied our costumes somewhat. We buttoned our clean collars to our collar buttons in the back of our shirts so that they hung down our backs under our vests, and carried them there until we needed them, when we made a change. We also wore overalls, which served to keep our

clothes clean while traveling and were worn underneath while selling goods. These tricks are common property among roadsters, being the outcome of stern necessity. We soon learned that if a person looked as though he needed to sell his goods it was very hard to do so, but if he looked as though he was simply doing it for the pleasure of the thing it was very easy. By trying successively various ways of selling we soon became experts and could sell at nearly every house we tried.

Probably there exists nowhere a stranger medley of people than the inhabitants of that indefinite place known as "on the road." Their numbers are constantly lessened by desertion and as constantly augmented by fresh arrivals. As far as I could learn by personal inquiry, there are two classes of reasons which throw these persons on the road—one a subjective one, restlessness, and the other an objective one, misfortune.

As for the proportion between the two, my opinion would not carry much weight, as I was with these people only one summer, and hardly learned any more than that the proportion varies greatly. At the time I did not make any classified study of each person, although I learned as well as possible from personal conversation the causes of their condition. The cases which I can recollect now seem to be about evenly divided between those who go on the road from choice and those who do so from necessity. I have reason to believe, however, that this is not the normal proportion, those who had to travel being more numerous than usual. Whenever I found veterans I found them complaining of the great number of recruits. As one tramp expressed it, "It's gittin' so a respectable 'boe [hoboe] can't get a hand out anywhere no more. This whole d—— country is on the bum."

I. *The class who are on the road from preference* is by far the more complicated. Perhaps I could describe it better by dividing it into two subheads—the tramp and the roadster proper. With each of these two classes we had about equal experience. At different periods we could be classed with each; we traveled, ate, and slept with them and were received into their number. I will discuss them separately.

(*a*) TRAMPS.—The first characteristic that strikes me as I recall my experience with them is their *indefiniteness*. Josiah Flynt, in his articles on tramps, has taken only the *élite* of the "profesh"—the tramp whose habits are born and bred into him and can hardly ever be entirely overcome. Besides these there is another class, last summer more numerous than the regular tramp, who would be placed on the border land of trampdom. They are traveling merely for the time being, and for the time being are no less distinctly tramps. They are men thrown out of work, who go on the road at first perhaps to find work. They get in

with the tramps, like their life, and travel with them. Some of them seem to be actuated by a genuine desire to see the country, others by a simple love of adventure and change. This latter class are liable to degenerate into real tramps, but the former are pretty sure to get tired of the hard life and settle down again. They never regard themselves as tramps, and if they beg do so feeling that they lower themselves by it. As a rule they much prefer to work in payment of their meals, or even take two or three days' work and then pay for what they eat until their money is exhausted. They are uniformly recruited from the working population of cities, men under thirty years of age, who though without education have a desire to see the world and have been employed in a situation where they have come in contact with ex-roadsters. Under favorable conditions they would develop into such a type as the average "prominent citizen" of our small towns. They possess energy, skill, and intelligence, but lack woefully in opportunity.

The tramp temporarily on the road from a love of adventure can scarcely be distinguished from the dyed-in-the-wool hoboe. He is in most cases recruited from the same city population, yet all classes of society are represented. One night we were coming home from Cadillac to Grand Rapids in a freight car with thirty-three others, and the question of what to do when we arrived at the Rapids was being discussed.

The day before several of the "lads" had been "pulled" at the Rapids for "bumming the freights," and the news was by this time known to all knights of the road for several hundred miles. Plans for evading the "cops" were discussed, and the question of the legal aspect of the case came up. To my surprise, one of the toughest of the lot dropped his tramp dialect and gave a very good discussion of the case. We began to question him, and when he found that we too had seen college days he began to cite cases, quote State laws from several different States, and, in short, gave a regular lawyer's brief. He afterward told us that he had graduated from a law school in New York city.

Tramps as a class are young men. I do not know what becomes of them when they are old or whether they ever get old, and, as far as I could discover, they do not know either. Their happy-go-lucky method of living leads them to give very little thought to the future, but the fact still remains that an old man can not live as they do. They uniformly travel by night and sleep by day. It is no uncommon sight to see fifteen or twenty of these lusty fellows asleep in the shade of some watering tank, and if you would take the pains to climb up the ladder and into the tank you would probably find a little room over the water occupied by four or five more. They are not so universally drunken

as the temperance advocates would have us suppose. One time when we were traveling by freight two of the lads brought on a bottle of whisky, and one of them offered it to several of us successively. Nobody would drink with him and he became abusive. The boys took his bottle away from him and threw it overboard, and compelled him to sit quiet until he fell asleep. But, on the other hand, their private morals are abominable. They seem to have no idea of personal purity whatever. I knew of one instance of a woman tramp who was supported by several male tramps with whom she traveled.

If you ask a tramp where he is going, he will probably answer vaguely, "Oh, down South, I guess," or "Out West," or some other equally indefinite place. If you urge him still further he may mention some State, but that will be as much as he can tell. They are like Wandering Jews, traveling because they can not stop. I saw only one place where any large number of tramps make a point of meeting, and that is the fruit region around St. Joseph. We picked berries there for a while during the season. Tramps swarmed there, together with large numbers of working people from Chicago and a number of ignorant foreign women from nobody knows where. They picked for two and a half cents a quart and boarded themselves—that is, slept on the ground and boiled stolen potatoes in a tomato can. At the little village of Stevensville, the center of the district, dance booths were erected, beer sold at three cents, and each night was made hideous by the squeaking of the fiddles and the drunken songs of the dancers. Finally, a murder occurred, and in desperation the farmers drove the whole gang away with shotguns. I learned from those who had been there that in the hop fields of New York and Wisconsin similar scenes occur. Many go direct from the berries to the hops.

(*b*) The roadster proper is distinguished from the tramp by having a "graft," or in other terms a visible means of support. The graft consists of any method at all to gain money aside from begging or chance jobs. For instance, our tidy-holders were "an out-of-sight good graft." We found one tramp who sold a kind of soap made by himself, which he guaranteed to take out any spot whatever. It really did so, but the spot was pretty sure to reappear the next day. I knew another who sold soap which looked like Castile. A week after it was bought it dried up into half its original size and became absolutely worthless. Another had made a sore on his arm with acid, and begged by showing this sore and telling some pitiful tale. As for such means of exciting sympathy their name is legion.

I found that there are several firms throughout the country who make it a business to supply grafts to tramps. For example, there are publishing houses where the professional beggar may

obtain printed cards which will be of great assistance to him. The one-legged man will find a selection of most heart-rending poetry under titles such as The Woodman's Lament or The Railroad Boy's Appeal. The lame, the halt, and the blind are all provided with cards at so much per hundred. Another firm will make a specialty of so-called high-class novelties, and will issue a Mammoth Catalogue, probably advertised with a picture of a cat. Here you will find listed pewter spoons at twenty-five cents per dozen, tied with pink ribbon in half-dozen lots, and each spoon labeled sterling silver and done up separately in white tissue paper. Spectacles may be bought for two dollars and a quarter per dozen for the man who "just found a pair of gold-bowed spectacles down the road, and if they fit you, you may have them for two dollars, as I have no use for them." Not all grafts, however, are dishonest. The sale of pencils, paper, and in fact any article sold by tramps, would come under this definition.

There is also a large number of persons in this class whose employment is not at first sight apparent. Professional gamblers and book-makers are obliged by the nature of their employment to be on the move constantly. When in luck they spend their money lavishly, yet in case of pinch they take to the freight without a grumble. We traveled quite a distance with two such characters. They were dressed in immaculate linen, tailor-made suits, and derbies, and looked entirely out of place. In this class there belong a number of people who are not tramps in any sense of the word. The chronic book agent is an example. They follow the occupation because they have something in their character which will not allow them to remain quiet. Most women on the road might be classed among these—indeed, permanent canvassers are more often women than men.

The women on the road seem to be much more irreclaimable than the men. They have less true politeness, less sense of honor, and if dishonest are much more subtle. In a religious community they are invariably religious, and have uniformly been abandoned by their husbands and have six children dependent on their efforts. Male agents, as a rule, will be fair with each other and have a strong *esprit de corps*, but for the female agent everything is fish that comes into her net.

There are several trades whose members seem condemned to be perpetually on the road. Printers and hotel cooks are a case to the point. We traveled with a hotel cook for a couple of weeks who is a good example of his class. He had at different times been a brakeman, a school teacher, an expert accountant, a bookkeeper, a sailor, an agent, a basket-maker, and a cook. If necessity demanded, he could be anything else on short notice, as we soon found out. It seemed impossible for him to settle down. When

he traveled he always spoke to the cook in some hotel at meal times and received a good meal gratis, a favor which he would repay some time if chance offered.

The greater part of this class perform no economic function whatever. Printers do not travel of necessity, but simply because it has become a custom with their trade. Agents of various sorts, of course, do perform a function, yet their work could be done as well if left to the retail stores. They make more profit on their goods than does the average retailer.

All of these classes have one thing in common—a roving disposition—and are divided by the possession or lack of other qualities. If the character we are discussing has the tramp instinct, but lacks both in mental ability and moral stamina, he will be a mere tramp; grant him some degree of mental ability, and he takes up a graft. If we give him a moral stamina without mental ability, we have the man temporarily tramping to see the country, while if we give him both intelligence and moral fiber he becomes a canvasser or roadster proper.

II. *The class who travel from necessity* is one of the most interesting spectacles in the border land of trampdom. Here we see the real tramp in the process of formation. When a young unmarried laborer is thrown out of employment and finds none where he is, he generally stays until his money is exhausted and then goes on the road in search of work. His case is genuine, but he is brought into disrepute because all tramps pretend to belong to this class. If he finds work within a short time, his experience will not result very badly for him, but if he is forced to remain a tramp for a month or so he is quite likely to lose his independence and join the ranks for good. In any case it is easier for him to take to the road in event of another lack of employment, and each time he does so he is more liable to become a permanent tramp.

It is surprising how large a number of men have belonged to this class at one period or another. Many laboring men when traveling prefer to go by freight in order to save expense. They do not think it a disgrace at all. Indeed, they rather regard ability to make one's way rapidly over the country without expense as an important part of their education, and the more I know of the vicissitudes in the lives of our workingmen, the more I am inclined to agree with them.

In dealing with the tramp question we must consider the distinctions just noted. The man who travels simply because he wants to, wastes his energy and ought to be suppressed, both for his own good and the good of society in general. But with the man who travels because he has to things are very different. He *must* travel. It is a critical time in his life. Forces are acting on

him which tend to weaken his self-reliance, his honesty, and his self-respect, and bring him to the level of the common tramp. If he is given an opportunity of earning his living as a man and is treated like a man, chances are in his favor, but if he is forced to accept charity like a tramp he is very likely to become a tramp. I believe the establishment of municipal wood yards, run on the plan of those now found in many cities, to be the proper solution of the tramp problem. In these a meal or a night's lodging is given in payment for two or three hours' wood cutting. Then the co-operation of the citizens must be enlisted. They must cease entirely all private charity of this sort and send tramps to the wood yard. In this manner tramp life will lose the attraction of an easy, worthless existence. The wood yard will become abhorrent to the genuine tramp, but will be welcomed by those who are really forced on to the road by lack of work. The tramp who finds himself in this manner paying his way will in some measure regain his self-respect and will stand a better chance of being reclaimed.

SKETCH OF HENRY DARWIN ROGERS.

THE family of which the "Rogers brothers" were conspicuous members furnishes a striking instance of the concurrence of consanguinity and affinity of genius and mental tendencies, and its history affords a marked confirmation of the doctrine of hereditary genius. Instances of sons inheriting the mental qualities and capabilities from their fathers, and of brothers achieving distinction in allied or different lines of effort, are common enough and may be cited by the dozen, but very few can be found where so many members of the family became eminent at the same time and in fields so close to one another. In this family we have the father and four sons, all able teachers, and all becoming distinguished as geologists or chemists, and all—the brothers at least—gaining their fame on so nearly the same fields that they were able to co-operate with one another in experiments and in the preparation of papers. Doubtless the occupation of their father, which made him the academic as well as the parental teacher of the elder brothers, had much to do with shaping their tastes and giving direction to their studies, while the youngest, we learn, was taught under their direction. The relations of this quintet and of their work are admirably set forth in the late Dr. Ruschenberger's memorial sketch, which is our chief source of information concerning all of them.

Sketches have already been given of Prof. William B. Rogers, the second of the four brothers, in the ninth volume of the Popu-

lar Science Monthly, of James Blythe Rogers, the eldest of them, in the June number, and of Robert Empie Rogers, the fourth, in October, 1896.

HENRY DARWIN ROGERS, the third of the brothers, was born in Philadelphia, August 1, 1808, and died near Glasgow, Scotland, May 29, 1866. His middle name was given him in honor of Erasmus Darwin, of whose poem, The Botanic Garden, his father was a great admirer. He was educated at Baltimore and at Williamsburg, Va., where his father was Professor of Natural Philosophy and Mathematics in William and Mary College from 1819 till 1828, the year of his death. The first notice we find of Henry's early work is the mention in Dr. Ruschenberger's sketch of a school set up by him and his brother William in the suburbs of Baltimore. In January, 1830, when he was not yet twenty-two years old, he was elected Professor of Chemistry and Natural Philosophy in Dickinson College. During the year in which he held the professorship he edited a monthly scientific magazine, The Messenger of Useful Knowledge, to which his brother contributed a series of short articles on the Formation of Dew, and in which educational, literary, and political articles and selections from foreign journals were also published. He resigned his professorship at the end of the year, and in 1831 went with Robert Dale Owen to England, where, with aid afforded him by his brother William, he studied chemistry in the laboratory of Dr. Edward Turner, and attended other scientific lectures in London, including those of De la Beche on geology. He returned to Philadelphia in the summer of 1833, and in the ensuing winter delivered a course of lectures on geology in the hall of the Franklin Institute. He was made a member of this society, on the nomination of Alexander Dallas Bache, in January, 1834; was a member of its Board of Managers from 1838 till 1843; and resigned his membership in it in March, 1848.

Having received the degree of Master of Arts from the University of Pennsylvania in 1834, he was elected Professor of Geology and Mineralogy in that institution in 1835. This chair he held—giving regular instruction—till 1846, when he resigned. One of the fruits of his labors there was the small publication, A Guide to a Course of Lectures on Geology, delivered in the University of Pennsylvania.

In 1835 Mr. Rogers was appointed by the Legislature of that State to make a geological and mineralogical survey of New Jersey. He published a small preliminary report of the progress of his work in 1836, and in 1840 a larger report, with maps, entitled Description of the Geology of the State of New Jersey. The report of 1836 gave the first descriptive section that was made of the cretaceous formation of that State, and the first pub-

lished results of systematic field studies of a system which has since been elaborately investigated by other geologists.

The Geological Society of Pennsylvania, though its career was only brief—1832 to 1836—lived long enough and was vigorous enough to secure the institution by the Legislature in 1836 of a geological survey of that State. On the organization of the survey, Prof. Rogers was appointed geologist, with James Curtis Booth and John F. Frazer assistant geologists, and Robert E. Rogers, the fourth of the "Rogers brothers," chemist. Six annual reports of the progress of this survey were made to the Legislature from 1846 to 1852, when it was suspended through the failure of the two houses to make an appropriation for its further prosecution. For the next ten years—1842 to 1851—Prof. Rogers was employed by various coal companies as an expert. During this period—in 1846—he established his residence in Boston. In 1855 the preparation of a final report of the Pennsylvania Geological Survey was committed to him, on condition that he should receive sixteen thousand dollars, should furnish the State one thousand copies of the book, and should own the copyright of it. In order to command the best work possible with the amount appropriated by the State, he had the printing and engraving of the book done in Edinburgh, more cheaply and quickly than they could be afforded in like style in the United States, and removed there in order to supervise them. The report, which embodies the results of eighteen years of labor, brought the author fame and applause, but pecuniary loss instead of profit; for the cost of it exceeded the appropriation by many thousand dollars. The book, in two quarto volumes, contains 1682 pages, is illustrated by 778 woodcuts and diagrams in the text, 69 plates, and 18 folded sheets of sections, and was published by W. Blackwood & Sons (London and Edinburgh), and J. B. Lippincott & Co., Philadelphia, in 1858. The highest commendation was given to this work by Prof. Rogers's successor on the geological survey, who said that, on the reading of the special memoirs at the end of the second volume, there could be "no sentiment but one of admiration for the breadth of his views and the clearness, force, and elegance of his delineations. No geological paper has ever appeared excelling in every good quality his memoir on coal."

In a report of the proceedings of the American Academy of Arts and Sciences, of which Prof. Rogers was a member, dated May 28, 1867, these words appear: "His first systematic geological labor was that of conducting the survey of the State of New Jersey. . . . While thus engaged, a similar survey of the great State of Pennsylvania was provided for by the Legislature, and placed under his direction. . . . During the early progress of this work he produced in conjunction with his brother,

William B. Rogers, the well-known memoir, On the Physical Structure of the Appalachian Chain, unfolding certain dynamical laws which have regulated the elevation of mountain chains. About the same time (1842) he published an elaborate paper on the origin of the Appalachian coal strata, bituminous and anthracite, containing much original observation and important speculative views, his brother pursuing a parallel system of investigation in Virginia, where the formations are identical with those of Pennsylvania. The result of the labor of these two brothers, carried on for ten years together, was the grand discovery of the structural unity of central North America, between the Appalachian chain and the Rocky Mountains, the Great Lakes, and the Delta inclusive, a fact of such importance that it must serve in future as a guide to all general researches, since it is not reasonable to suppose that so large a portion of the earth's surface should have been formed in any other than the normal mode. . . . Prof. Rogers was one of the founders and an early president of the American Association of Geologists, which after an active and most useful career expanded into the American Association for the Advancement of Science.

"Although chiefly devoted to geological research, he paid much attention to those sciences of which geology is the extended application—natural history, climatology, and physical geography."

His work was appreciated abroad as well as at home. He received the degree of LL. D. from Trinity College, Dublin; was elected a Fellow of the Royal Society (London), and of the Royal Society of Edinburgh, and of many other important societies. He was also for two years the President of the Philosophical Society of Glasgow. He became one of the conductors of the Edinburgh New Philosophical Journal, and was associated with Sir William and A. K. Johnston in the publication of maps of physical geography and geology, particularly of a geological map of the United States and a chart of the arctic regions in their Physical Atlas.

The anniversary address of the President of the Geological Society (London), in a notice of Prof. Rogers, contains the following estimate of his work as a geologist:

"While employed upon his great survey he had contributed to the Proceedings of this society a paper entitled Some Facts in the Geology of the Central and West Portions of North America. In this address he dwelt especially on those great features which he had elaborated in his survey, the disturbance of the Palæozoic rocks of the Appalachian chain, 'a stupendous undulation or wavelike pulsation, the strata being elevated into permanent anticlinal and synclinal flexures, remarkable for their wave-

like parallelism and for their steady declining gradation of curvature when they are compared in any east and west section across the corrugated zone.' To the westward of the Appalachian chain, where this structure is conspicuous, he pointed out that 'the crust waves flatten out, recede from each other, and vanish into general horizontality.' Coupled with these leading features he remarked that the total thickness of the coal measures steadily diminishes from some three thousand feet thick in Pennsylvania to fifteen hundred feet in the Illinois basin, and to not more than one thousand feet in the basins of Ohio and Missouri; and similarly the number of workable seams of coal diminishes from twenty-five on the Schuylkill to probably seven in Indiana and Illinois, and but three or four in Iowa and Missouri. And when we add to this the clearly established facts of the increasing amounts of sea deposits simultaneously with the decrease of land-derived materials eastward and the diminishing effects of metamorphoses in the same direction, from the fully bituminous coals of the Western States to the hard anthracites of the most disturbed region, it must be conceded that Prof. Rogers contributed a noble quota to the unraveling of some of the grandest phenomena which geologists have been called upon to investigate."

In the autumn of 1857 Prof. Rogers was appointed Regius Professor of Natural History in the University of Glasgow, which position he held until his death. A Glasgow paper thus describes his inaugural lecture:

"The hall was densely crowded and the lecture of the learned gentleman was listened to throughout with the most decorous attention, broken only at intervals when some passage of surpassing beauty evoked the spontaneous applause of the alumni. To great scientific attainments Prof. Rogers unites great popular ability. His intellectual faculties are admirably balanced. It would be difficult indeed to say whether the analytic or synthetic faculty is the stronger, so delicate is the poise of power. . . . It would be doing injustice to Prof. Rogers to attempt so much as an outline of the lecture delivered yesterday; suffice it to say that, as far as any lecture could be so, it was an exhaustive synopsis of the wide field of scientific research embraced under his professoriate. The grouping of the varied branches of the general subject was executed with the utmost precision and completeness. The marvels of Nature that were met at every turning in the path of investigation were brought most happily before the imagination of the neophytes of science, while the great practical results of the study of natural history were never once lost sight of, even in presence of its most gorgeous visions."

Prof. Rogers returned with his family to the United States on a visit in the summer of 1865. He went back to Scotland alone in

the following April, in order to resume his teaching of the summer classes of medical students in zoölogy. In May, word was received by his family that he was ill. Mrs. Rogers, with two of Prof. Rogers's brothers, took the first steamer to go to him, but when they reached Liverpool they learned that he had died several days before, of erysipelas.

The following notices of Prof. Rogers appeared in Philadelphia papers shortly after his death:

"It is difficult and perhaps impossible in the compass of a notice like the present to convey an adequate notion of the general attainments of Prof. Rogers, or of his peculiar views in geological science. As a geologist he might be termed a paroxysmist, although he preferred to give full weight to the operation of those ordinary causes which are gradually and silently working to bring about the changes everywhere recorded on the surface of the earth. But he believed that many of the more marked cosmical phenomena could not be sufficiently explained without a resort to the doctrine of catastrophes, and he deliberately though modestly announced his opinion in these respects. His acquirements in all departments of physics were considerable, to which he added the accomplishment of a large acquaintance with our own literature and that of other countries. Accustomed to consider closely the important social and ethical questions which engage the attention of enlightened men, he brought to their examination an accuracy and breadth of observation derived from his habits of scientific investigation.

"Prof. Rogers was a member of many learned societies both in Europe and America, and his scientific brethren will amply honor his memory. We may add that, though representing America in a foreign university for many years, his patriotism was fervent, and he was able to defend and maintain the cause of the Union at all times and under all circumstances."

Another paper said:

"As a lecturer Prof. Rogers's excellences will long live in the recollections of his Philadelphia auditors. His calm, impressive tone, thoroughly well sustained and occasionally rising with the swell of his subject to a high pitch of eloquence, his quiet, gentlemanly bearing, his thorough mastery of and deep interest in his subjects never failed to kindle even in the most indifferent listeners at least a temporary glow responsive to the feeling of his own breast. He has passed away, and left a name not soon to be forgotten by the cultivators of science, and a place among his friends and associates that can not without great difficulty be supplied."

"Of him whom we have lost," says the minute of the American Academy of Arts and Sciences, "suffice it to record here in simplest and briefest phrase that he was a most accomplished

investigator, a graceful and persuasive teacher, and fascinating companion; that to rare powers and attainments he added a lively sympathy in all the interests of humanity, and a courageous devotion to whatever he deemed just and true."

Besides the reports and books already named and the periodicals he conducted, Prof. Rogers was the author of thirty-seven papers in scientific serial and other publications, he and William B. Rogers of eight, and he and Martin H. Boyé of one paper.

He was chosen a member of the American Philosophical Society, and a member of the Academy of Natural Sciences of Philadelphia in 1835. He was elected an honorary member of the Boston Society of Natural History in 1842, and participated in discussions at its meetings nearly every year from 1845 till 1858, speaking usually on geological facts or theories.

Other societies besides those already mentioned of which Prof. Rogers was a member were the Geological Society of London, the Royal Geographical Society, and the Anthropological Society of London.

M. ALBERT GAUDRY, in a review of the course of development of animate nature through the geological ages, remarks on a curious analogy between the changes experienced by fishes in the Secondary age and those which modern warships are passing through. As soon as the thought of armoring vessels took effect, stronger projectiles were devised, in order to penetrate the armor. Then the armor had to be strengthened, and just as rapidly as the plates were made thicker, more enormous projectiles were cast; so that the race has culminated in the construction of vessels so heavy that they are almost unmanageable, and thought is turning again toward light, swift boats. With the Secondary fishes, too, offensive arms and defensive armor were developed pace by pace. The teeth were modified till they could crush through the hard cuirasses of the ganoids, and the Secondary beds are characterized by marine animals thus furnished. Powerful grinding teeth are found in the bony and the cartilaginous fishes, and even in many of the massive reptiles of the Trias. The fishes, exposed to enemies whose instruments of offense matched their defensive armor, were obliged to seek safety in flight. Their vertebral column became more solid, so as to furnish a strong support to their spinal muscles, and their tails were shortened and broadened so as to become instruments of energetic locomotion. When this transformation was completed, the carnivorous fishes had no more use for crushing teeth, and they have almost disappeared; no more marine reptiles with teeth like paving stones are found in the Tertiary beds or in modern times; and fishes with large teeth working like millstones are rare in comparison to those which have thin cutting teeth; and power resides in agility to reach the goal or escape the danger. Existing fishes are marked by an activity that was unknown in the ancient oceans, and justify the observation of Moquen Tandon, that "the agitation and inconstancy of the sea seem to have impressed themselves on the beings which live in its waves, in the suppleness, rapidity, and vivacity of their movements."

Correspondence.

THE MORAL OF THE "SYMPSYCHOGRAPH."

Editor Popular Science Monthly:

SIR: I was both surprised and humiliated to find on my return from Bering Sea, a few days ago, a large correspondence from persons who had taken the "Sympsychograph" seriously. I had not the slightest idea that any one capable of "reading bound books" would be deceived by the meaningless phrases in that bit of burlesque. I intended it as a piece of gentle satire on the "wizards" and "impressionists" who follow in the wake of scientific work which attracts attention, and who pour their vagaries into the long ears of the daily newspaper.

The important element of one's belief arises from the way in which that belief is formed. No one was capable of understanding my story who did not at once see the incongruity of it. One might as well believe in Mahatmas and Odic forces as in cathode radiation or evolution if he does not have any clear ideas or a clear conception of the basis on which generalizations rest. One writer speaks of the article in question as a hoax upon an innocent public; but a public which has swallowed the alleged experiments of Inglis Rogers and other impressionists as scientific truth, and does not see any difference between the methods of these persons and the methods of Röntgen and Helmholtz, is not an innocent public. A vast amount of suffering in our society arises from the fact that men are ready to follow any notion in medicine, in politics, or in social reform, no matter how absurd, if it contains an element of mystery, or if it proposes to make life a little easier for men incapable of clear thinking.

I had a serious moral in the fable, and this, at the risk of trying to explain a joke, I shall give.

The methods ascribed to the "Astral Camera Club" are those which never have yielded and never can yield any results to science. Scientific investigators are not "wizards," their discoveries are not presaged by uncanny feelings nor green darkness, nor is there anything "occult" about their ways of working. They are simply men of unusual persistence and steady common sense. Everything easy was found out long ago, and additions to knowledge can only come from mastery of past achievements and mathematical accuracy in the registration of small details. The progress of science is not marked by surprises and contradictions. The result of scientific inquiry comes as a surprise only to those ignorant of the steps in investigation which leads up to it.

The discovery that the peculiar rays called "X" by Röntgen could be made to cast shadows on a sensitized plate does not imply that thought can be photographed. One might sooner expect to photograph the songs of birds than "the cat's idea of man."

The great power which exact knowledge gives adds nothing to the probability of the mythology of our own or other times. The "power of mind over matter" is not a form of hysterics. It depends on exact knowledge of the nature of material things. It is no occult influence showing itself in neurotic "adepts" by uncanny lights, under "astral" conditions. It is greatest by daylight, with sane men, with whom science is simply enlightened "common sense."

DAVID STARR JORDAN.

PALO ALTO, CAL., *October* 10, 1896.

SHALL VIVISECTION BE RESTRICTED?

Editor Popular Science Monthly:

SIR: In his interesting and valuable contribution to the literature of vivisection, in the October number of your periodical, Prof. Hodge makes one or two statements which are decidedly erroneous, and which I beg you will permit me to correct. Quoting from an article of my own on the same subject, published over twelve years ago in Lippincott's, he states that "a recent writer has actually cited mortality statistics to prove the futility of vivisection." This deduction is wholly incorrect. The very book from which he quotes, again and again affirms the use of vivisection. Exaggerated claims of potency, such as were rife when this article was written, some fourteen years ago, may certainly be challenged, without being carelessly translated into affirmation of "futility"; just as one may believe in experiments regarding aërial navigation without looking forward to lunar voyages.

With the gratuitous imputation of "unfairness" in the selection of statistics I am more seriously concerned, for no charge more vitally affects the character of scientific work. Prof. Hodge admits, as he is forced to do, that "the figures do show that in England, since 1850, certain organic diseases have been on the increase, despite the slight advance in our knowledge of them." Well, that also is my own conclusion. Such facts as these "afford the strongest possible argument for the side of research." Again I agree with your learned contributor, although I should give the word "research"

a wider meaning than he intends. But there was "unfairness" in the selection of diseases; "almost without exception these maladies lie very deep in the hereditary tendencies of the race." Well, I suppose death itself may be said to "lie very deep in our hereditary tendencies"; but, except in some such exceedingly broad sense, I certainly question the accuracy of his assertion. In my tables (see Lippincott's, August, 1884) only fifteen different classes of organic diseases were tabulated, and among them were apoplexy, aneurism, diabetes, insanity, paralysis, cancer, diseases of the heart, the brain, the kidneys, and the liver. From these causes only result the deaths of two thirds of the English race over the age of twenty years; and, as a rule, fatality increases with advancing age. Are these maladies "almost without exception" caused by "hereditary tendencies"? When the Archbishop of Canterbury, in the fullness of years, falls dead from apoplexy, is it because "defectives leave enfeebled progeny"? I certainly differ with your learned contributor on this point. There was no unfairness whatever in concentrating attention upon organic diseases, *provided* it was distinctly admitted—as it was in the same article—that "during later years there has been a diminished mortality in England from the lesser prevalence of zymotic diseases," which nobody in 1884 was pretending to "cure."

One point more. Admitting the justification of vivisection *per se*, are we compelled to adopt the further evident conclusion of Prof. Hodge that it should be free to proceed to any lengths whatever, as in Continental Europe? Because certain forms of vivisection are justifiable, *are all?* It is at this point we part company. He is a brave man who can announce in these days a new theological dogma, that "God clearly gives to man every sanction to cause any amount of physical pain which he may find expedient to unravel his laws." Certainly that is a dogma of the highest import; everything is justifiable; its far-reaching consequences touch humanity itself. With that doctrine I thoroughly disagree, upheld though it be by so eminent a teacher as Prof. Hodge. Permit me rather to range myself with one whose work for science entitles him to even greater respect. On the wall of my library hangs a printed statement of views concerning this very subject, from which allow me to quote. "Within certain limitations, we regard vivisection to be so justified by utility as to be legitimate, expedient, and right. Beyond those boundaries it is cruel, monstrous, and wrong. Experimentation . . . we consider justifiable when employed to determine the action of new remedies; for tests of suspected poisons, for the study of new methods of surgical procedure or in the search for the causation of disease. . . . On the other hand, we regard as cruel and wrong the infliction of torment upon animals in the search for physiological facts which have no conceivable relation to the treatment of human diseases; or experiments that seem to be made only for the purpose of gratifying a heartless curiosity. . . . The practice, whether in public or in private, should be restricted by law to certain definite objects, and surrounded by every possible safeguard against license and abuse."

That statement, sir, is signed by Herbert Spencer. With every word of it I agree.

ALBERT LEFFINGWELL, M. D.

HAMILTON CLUB, BROOKLYN, *October* 15, 1886.

INTERPRETATIONS OF MALTHUSIANISM.

Editor Popular Science Monthly:

SIR: I have been a reader of your periodical since 1873, and naturally during that time I have occasionally met with statements by some of its contributors that I felt were open to criticism—opinions that I thought a little weak. But never through all those years have I met with such a reckless misrepresentation as is contained in Helen Zimmern's first paper, in the September number, on Enrico Ferri on Homicide. In a sentence, about the middle of page 682, she says, "Infanticide, elevated to a custom and a method in Malthusianism." Such a statement would be unworthy a correspondent of a decent newspaper; but, that any contributor to the Popular Science Monthly should, whatever his personal intolerance of the population question, have the temerity to hazard such a false presentment of the theory (axiom I would call it) laid down by the Rev. Mr. Malthus, and the remedy he suggested, is, to say the least, hardly complimentary to the presumable information or intelligence of its readers.

The difference in the ratio of increase of population and that of subsistence, which Mr. Malthus, rightly or wrongly, submitted as being a fundamental law, and the remedy, wisely or unwisely, he suggested of deferred marriages, are all that can be laid to his charge. Surely these are not sufficient grounds to justify the accusation against him of advocating "infanticide"! It reminds one of the old trick of many of the clergy, associating immorality with atheism.

Certainly, there is now a numerous and rapidly growing class, recognizing the irrevocable nature of the law of population, but, at the same time, the impracticability of Mr. Malthus's remedy, who adopt and recommend *preventive* means. Yet, how even such can be accused of "infanticide" any more consistently than others who practice *abstinence* (which is just one method of prevention) it is difficult to perceive.

I feel that this is no occasion for ventilating my own particular views on the population question or Malthusianism; still, I have always been surprised at observing the avoidance of the subject manifested on the part

of many men of high standing who yet recognize and accept its truths. It is this sort of neglect or cowardice, I think, which emboldens some minds to gratify their resentment of opinions or views they have a sentimental repugnance to by indulging in the sly thrust; trusting to the perhaps unpopular nature of the matter for their immunity from consequences.

I can not conceive Helen Zimmern being as ignorant of Malthus's writings as the words I quote from her paper would imply; and I am very unwilling to suppose she would *willfully* misrepresent.

Respectfully, ARTHUR F. PALMER.

152 CRAWFORD ROAD, CLEVELAND, OHIO, *September* 30, 1896.

NATIVE AMERICAN POTTERY.

Editor Popular Science Monthly:

SIR: Of course the name "Alaska" is a slip of the pen with Madame Le Plongeon in the September Popular Science Monthly, whatever other locality the distinguished writer may have had in mind. The only pottery to be seen in Alaska is exceedingly rude, perhaps the worst in the world. The Athapascans of the interior boil food in baskets and boxes, with hot stones. The Tlingit (Koloschan) of the coast have no pottery, using boxes of alder and other woods for vessels. The Aleuts have no pottery and no substitutes therefor, except such dishes as they make from driftwood. But the Eskimo tribes about Bristol Bay do mix up mud with hair and blood to form their lamps and grease bowls. Excepting this rude ware, there was no pottery made by the Pacific coast tribes between the Santa Barbara Islands, Lower California, and the Eskimo of Bristol Bay. Thirty-five of the families or stocks of Indians north of Mexico are not known to have ever practiced making pottery.

OTIS T. MASON.

WASHINGTON, D. C., *September* 7, 1896.

Editor's Table.

A THEOLOGICAL VIEW OF EVOLUTION.

ON more than one occasion lately we have had to note the growing liberality of theological thought in relation to scientific questions; and we now have before us another striking example of the same tendency in an address delivered at the recent Church Congress in England by Archdeacon Wilson, of Manchester, on The Bearing of the Theory of Evolution on Christian Doctrine. Thoughtless critics sometimes endeavor to cast ridicule upon the clergy for troubling themselves with discussions of this kind. Their idea is that theologians should expound and develop their doctrines in entire independence of, if not indifference to, what the scientific world may be doing, and that the scientific workers should equally ignore theology. We can not accept such a view. The human mind is not built in thought-tight compartments, if we may use the expression. Every thought honestly entertained claims the privilege of traveling everywhere, and asks for illustration and confirmation wherever it goes. If the scientific man is a religious man he will want to blend his science with his religion, and the religious man will want to know that the doctrines to which he adheres are not contradicted by any portion of his acquired knowledge. If the leaders of religious thought were to withdraw from all interest in the teachings of science, the inference would certainly be drawn that they were conscious of a hopeless antagonism between the principles of science and the doctrines of religion. They would seem to present to the world the alternative: "Science *or* Religion; choose which you will, you can not have both."

Far better is the attitude of those who, believing in both, believing that men have need of religion, and that they can not deny the authority of science, strive to see what measure of

agreement there is between the teachings of one and the other. Such is the position of the Archdeacon of Manchester. In examining the theory of evolution he sees, in the first place, that it is no way inconsistent with theism; and, in the second, that it throws no difficulty in the way of recognizing the personality of the Divine Being that theologians were not already aware of and familiar with in connection with their own special studies. That problem would subsist even if no theory of evolution had ever been formulated. To quote the speaker's words: "No cell of a body could interpret the personality of the whole; and similarly we could not grasp the personality of God and his love and Fatherhood when we were thinking of all Nature as the expression of his will." As regards the creation of man, the archdeacon does not consider that there is any conflict between the theory of evolution and any essential Christian doctrine. "It was no part," he said, "of the doctrine of the Church—it was a comparatively modern theory of the naturalists, rashly accepted by the theologians of two centuries ago—that man was a special and underived species. He could imagine no sublimer conception of the nature or the dignity of man than that which saw all Nature as the self-manifestation of God rising into self-consciousness in man. Christian doctrine could adopt the evolutionary view of the creation of man; it was pledged to no other."

Passing to the doctrine of the Fall of Man, the speaker acknowledged that, in the light of evolution, the generally received view required considerable readjustment. We quote again: "Man fell, according to science, when he first became conscious of the conflict of freedom and conscience. Now, this conflict of freedom and conscience was precisely what was related as 'The Fall' *sub specie historiæ*. It told of the fall of a creature from unconscious ignorance to conscious guilt, expressing itself in hiding from the presence of God. But this fall from innocence was in another sense a rise to a higher grade of being. It was in this sense that the theory of evolution taught us to interpret the story of the Fall. It gave a deeper meaning to the truth that sin was lawlessness." Closely connected with the doctrine of the Fall is the doctrine of Atonement, and that, too, the speaker stated, must undergo modification and accept a broader basis. Such is the evident meaning of the following passage: "The theory of evolution is, indeed, fatal to certain quasi-mythological doctrines of the Atonement which once prevailed, but it is in harmony with their spirit. It has become impossible to regard redemption as an afterthought, as a plan devised by a resourceful Creator, in Miltonic fashion, to meet an emergency. It has become impossible to the evolutionist to retain what was once the ordinary view of the supernatural as an interference with the natural, as an interposition from another sphere. Such dualism is repugnant to him. All progress being the result of struggle and sacrifice, the Atonement is God's identification of himself with the human race in that ceaseless struggle, manifested specially in the supreme sacrifice of the sinless Christ, but also in all human life lived in the spirit of Christ. This identification is the Atonement, the reconciliation, and in it the evolutionist, not less than the theologian, finds new hope and power, a release from sin, a real forgiveness and redemption." The speaker did not profess to be able to see his way through all the difficulties of his subject, but he made the broad statement that "thought is

being transformed by scientific method, and along with thought theology must change in form on some such lines as these." The following remarks on the subject of sin recall very strongly the views of Mr. Herbert Spencer: "It seems plain that if sin is a transgression and goodness the fulfillment of the law of man's higher nature, the consequences of sin and of goodness are not arbitrary nor external; they are in ourselves. They are the being what we have become, the sinking to the lower or the rising to the higher."

It seems to us that in this address—even in the few extracts we have made—there is much food for reflection. We may each form our own estimate of the success with which the author has applied himself to the task of reconciling the scientific philosophy of the age with Christian doctrine; but it seems clear to us that the effort to give at once a rational basis and interpretation to the accepted teachings of religion and a religious character to the principles of science is in every way commendable. There is not too much science in the world today, nor is there too much religion; and it can neither do the religionist any harm to know that the doctrines in which he places faith may be regarded as part of the rational interpretation of the universe, nor the scientist to know that the intellectual aspect of his theories is not all—that they have their moral and spiritual implications to which he would do well to take heed. The final aim of all intellectual effort should be the wise government of human life; and science does not properly fulfill its function, does not do justice to its own mission in the world, unless it endeavors to moralize its message to mankind. There has been too great a willingness, if we may say so, on the part of scientific investigators to fling broadcast crude theoretical conclusions, without any care as to how they may be correlated with the general body of human beliefs and sentiments. Science, under this treatment, loses much of the charm with which it ought to be invested, and arouses a certain instinctive repugnance against itself and its professors in the popular mind. Hard-headed and ambitious men, on the other hand, see in it an excellent road to money-making, and nothing more. Properly presented to the world, it might, as Wordsworth says of duty, wear "the Godhead's most benignant grace"; and it is to the credit of the theologians that many of them are endeavoring so to present it. The Archdeacon of Manchester is not far wrong when he says that "the needs of the human heart are much the same as they were four thousand years ago." A recent writer who, though chiefly known as the author of fantastic tales, is understood to be a strong man of science in certain lines—Mr. H. G. Wells—would carry this statement much further back than four thousand years.* At any rate, there is such a thing as the human heart, and it wants a word now and then. It may be impossible perhaps for science, as science, to speak the word; but it should at least welcome every alliance which, while leaving it due freedom of action, may help to bring it a little nearer to the instinctive needs and higher moral sentiments and aspirations of humanity.

INTERNATIONAL SCIENCE.

It was a favorite dream of the early political economists that the expansion of international trade would gradually unify the world,

* See an article in the October Fortnightly Review—Evolution an Artificial Process.

that it would so educate the nations in the peaceful arts that, at no distant day, they would resolve to learn war no more, so that Astræa, if she were so minded, might return to the plains of earth and find nothing to remind her of the conflicts and bloodshed which, according to the poets, had caused her to take her flight. If things could have gone just as the early economists wished and hoped, something like this might have come, or be about to come, to pass. They thought that commerce was going to shake off its shackles, that trade was going to be free, and that the mutual benefits which it would bestow would, year by year, strengthen the feeling of friendship between nation and nation. They did not foresee such a revival of the prejudice-breeding protectionist system as our eyes have witnessed, or the greed for colonial acquisitions which it has introduced into the world. They magnified unduly the rôle which reason was going to play in the affairs of men, and made inadequate allowance for the measureless floods of popular ignorance which popular education would disengage and set into activity. Still, their dream was no discredit to them, and one of these days, after a greater lapse of time than they counted on, it may come true.

But what trade has not yet accomplished, and does not, as things are at present, seem in the way of accomplishing, another force is silently laboring to achieve. That force is science. It is cosmopolitan by nature; something more than the world even is its parish. We all remember the story of Goethe, who, when the Revolution of July, 1830, broke out in France, and was creating commotion and trepidation more or less throughout Europe, was so absorbed in thinking of the controversy between Cuvier and Geoffroy de Saint-Hilaire over the theory of development, which had become acute just at the same time, that he completely mystified a friend who had come to see him by talking with the greatest excitement about the intellectual crisis when the friend was thinking of the political one. It seemed to Goethe an enormous descent to come down from the level of a great scientific and philosophical problem to a mere question as to the precise form of monarchical government which was to prevail in a certain country. To him the protagonists on the world's theater were not the Polignacs, the Periers, or the Metternichs of the hour, but the leaders of thought and the representatives of science. Goethe has been accused of lack of patriotism; but we may put it to his credit that he was free from those sentiments of rancor toward foreigners which constitute so large a portion of the patriotism of the majority. In his predominant interest in large intellectual questions he was a type of the better mind of the future, and pointed forward to the time when science would become a missionary of peace and concord to the jarring nations.

Two generations have passed since then, and science has made advances which, could he have lived to witness them, would have filled the great German with gratification and delight. That it is sensibly drawing the nations together there is no doubt. Scientific workers in every field of research are stretching out, across seas and continents, hands of friendship and help to their fellow-workers in other lands. Literatures are national, broadly speaking, but science is necessarily international. There is but one set of natural laws for the universe; and, broadly speaking again, the method of science is one. It fol-

lows that all who, the world over, are engaged in scientific work form but one army, one band, and move forward under one banner. This fact has been recognized by the formation of many international associations for the prosecution of different branches of scientific work. The physiologists, the psychologists, the criminologists, and several other sections of the great scientific corps have in this way organized for mutual assistance ; and it only remains to form one general international organization which shall in a manner preside over all the scattered provinces of science, and by its existence and activity give evidence to the world that science is one and that humanity should be one. We are glad to know that this important object is in a fair way of accomplishment. Next year the British and American Associations for the Advancement of Science will meet within about two hundred miles of one another, the one at Toronto and the other at Detroit; and it is expected that not only will the two associations contrive to meet and fraternize, but that steps will be taken toward establishing some bond of union between the two, and so preparing the way for a wider international organization. The scheme, it is further expected, will be followed up two years later when the British and French Associations will meet within about thirty miles of one another, one at Dover and the other at Boulogne; and if so a world meeting may possibly be arranged for the year 1900. Let science flourish, and let its influence over the nations increase! It means love of truth; it means reasonableness and equity; and if these things be in us and abound, there can not be much room for international hatred.

COMPLETION OF THE SYNTHETIC PHILOSOPHY.

THE publication of the concluding volume of Mr. Herbert Spencer's Synthetic Philosophy is an event of no small moment in the history of modern thought. No other doctrine of this or of any recent century has revealed so much in regard to the way in which organisms and institutions have come to be what they are as the evolutionary or synthetic philosophy has. Long before its great expounder had completed his presentation of it in the four fields of life, thought, society, and conduct, it had turned violent opposition into eager acceptance, and was being applied in countless researches, and was assumed as the only admissible standpoint for interpreting the past and predicting the future. The concluding division of his system deals with Industrial Institutions, and has been eagerly awaited with the expectation that it would throw needed light upon the industrial ferment of the times. This expectation it amply fulfills. Mr. Spencer's plan for a series of ten volumes in which the principles of evolution should be set forth with sufficient illustrative evidence was first issued in 1860. To do this work as he determined that it should be done was an immense undertaking, and he was further hampered at first by insufficient means, and throughout by seriously impaired health. That he has surmounted every obstacle and reached his goal may well inspire wonder, and notable too is the fact that his exposition has been completed substantially as proposed. Notwithstanding the progress of knowledge during the past third of a century, and notwithstanding, moreover, the widening of Mr. Spencer's own horizon, the plan that seemed good to the man of forty has proved acceptable to his riper self at seventy-six. Mr. Spencer is to be heartily

congratulated upon the completion of his task, but more fortunate than he is the world that has received the benefit of his labors.

Scientific Literature.

SPECIAL BOOKS.

THE trees, the author of this book * says, may be justly numbered among our best friends. But we need to know them better. "It is not enough to be able to distinguish an ash from a hickory or a fir from a spruce; it is more important by far that we should become acquainted with the form and character of the leaves, the fruit, and the bark, and thus acquire a fuller knowledge of the way the tree lives. To *know* a tree is to become familiar with the purpose and condition of its life. This is revealed in no small measure by the leaves. The needle of the pine enables the tree to withstand a hurricane on a mountain top, yet its slender figure is perfectly adapted to the task of gathering light and air for the tree's life. The broad-leaved buttonwood would fall before the gale which the pine successfully weathers. Not less plainly does the diversity of character in a leaf reveal the diversity of the tree itself. No two leaves are exactly alike; no two trees are exactly alike." Although, as he admits, it is not possible to portray all the beauty of a leaf with a pencil, the author has endeavored in this attractive volume to represent in outline the most characteristic features of the leaves of American trees, supplementing his pictures with such descriptions of them, and the trees to which they belong, with their habitat, as has seemed appropriate. Endeavoring to draw the leaves exactly as he found them, his two hundred and odd sketches were all taken from Nature, and only sixty of these from pressed specimens which were obtained at the Harvard Botanic Garden. "Yet I have found the world of truth and beauty, as far as leaves are concerned, so limitless that types and rules seemed valuable only as guide-boards are on a strange path." The botanical names are given, first from Gray's Field, Forest, and Garden Botany; second, in conformity with a recent system of nomenclature instituted by Prof. C. S. Sargent. An introduction is contributed by Prof. L. H. Bailey. The sketches begin with a chapter on The Leaf as a Builder, in which the leading features of the endless variety in the forms of leaves are briefly described and illustrated, and the functions of the leaf in the tree's life are explained. The leaves as they are singly brought up are classified as simple alternate, simple opposite, and then as with or without teeth and their edges divided or not divided, compound alternate and compound opposite, and evergreen leaves. Of the genera that are portrayed are the magnolias, tulip tree and sassafras, witch-hazel, sorrel tree, elms, birches, alder, willows, poplars, hawthorns, oaks, dogwood, burning bush, maples, ailantus and locusts, sumach, walnuts, hickories, ash-leaved maple and ashes, horse-chestnuts and buckeyes, pines, spruces, hemlock, fir, larch, and arbor vitæ. An intelligible plan for leaf identification occupies one page. A systemat-

* Familiar Trees and their Leaves. Described and illustrated by F. Schuyler Mathews. Pp. 320, 12mo. New York: D. Appleton & Co. Price, $1.75.

ical index of the trees of the eastern United States gives the common names and the botanical names according to Gray and Sargent, with the family to which each tree belongs.

This book* is not a description of scenery nor an account of Alpine adventures, but an inquiry into the agencies that have made Switzerland what it is. Its scenery, the author says, "is so greatly due to geological causes that it is impossible to discuss the present configuration of the surface without some reference to its history in bygone times. I do not, however, propose to deal with geology further than is necessary for my present purpose." He defines that purpose by remarking that during his holidays in the Alps "my attention was from the first directed to the interesting problems presented by the physical geography of the country. I longed to know what forces had raised the mountains, hollowed out the lakes, and directed the rivers. During all my holidays these questions have occupied my thoughts, and I have read much of what has been written about them." While the book, notwithstanding its somewhat clumsy construction, will be an acceptable one to every reflecting reader, it will be most welcome to one who is interested in geology. He need not be a geologist, nor much versed in that science, for the author has supplied a very good elementary geological introduction to the work, in which those geological points that have immediate application to the matter in hand are sufficiently explained. But he must want to know why such and such features are so, for that is what the book undertakes to tell. With such a mind, every student and tourist will find the book pleasant and profitable. First is given the geological introduction, with especial reference, of course, to Switzerland. Then the origin of mountains is discussed, and the general peculiarities of the mountains of Switzerland are noticed. The phenomena caused by the accumulation and action of ice and snow are considered, the former extension of glaciers, the origin and formation of valleys, the action of rivers, their directions, the character and origin of the lakes, and the influence of the strata upon scenery. Pursuing the study more in detail, attention is directed to the Jura, the central plain, the outer Alps, the central massives, the Lake of Geneva, the massive of Mont Blanc, the Valois, the Bernese Oberland, the upper Aar, Zurich and Glarus, the Rhine, the Reuss, the Ticino, and the Engadine, closing with a general summary of the geological history of Switzerland. A list of works and memoirs referred to is given in the appendix. The work is accompanied with more than one hundred and fifty suitable illustrations and an excellent map.

It is idle to speculate as to whether Herbart could have done the work in education that Locke or Pestalozzi did, but certain it is that, having the work of the older men to stand upon, he accomplished what they could not do. Herbart's service it was to unite into one system the grand isolated principles established by the pioneers of modern education. The volume before us† presents Herbart's ideas as set forth in seven of his essays, two

* The Scenery of Switzerland and the Causes to which it is Due. By the Right Hon. Sir John Lubbock. Pp. 371, 12mo. New York and London: The Macmillan Company. Price, $1.50.

† Herbart's A B C of Sense-Perception and Minor Pedagogical Works. Translated, with Introduction, Notes, and Commentary, by William J. Eckoff. International Education Series, vol. xxxvi. Pp. 288, 12mo. New York: D. Appleton & Co. Price, $1.50.

of which discuss Pestalozzi's theories, and in his book, whose title is translated as Pestalozzi's Idea of an A B C of Sense-Perception investigated and scientifically carried out as a Cycle of Preliminary Exercise in the Apperception of Forms. In one of the essays he sets forth the insufficiency of empiricism in pedagogy, and draws an instructive parallel between tact and character; in another he insists that success in moral as well as in intellectual education depends on the proper psychologic grading of the training conferred. In still another he advocates many-sidedness in schools while at the same time showing the impossibility of satisfying all the "faddists," and follows this by demanding as much free time for the pupil as can be secured by economy of the working hours. His conception of pedagogy as a whole is laid down in the essay On the Æsthetic Presentation of the Universe as the Chief Office of Education. As to what constitutes presentation of the universe, his own words are "experience, human converse, and instruction taken all together." Conceding that the object of learning is doing, we must know what is right in order to do what is right, and besides this there must be the desire to do right. Knowledge and sympathy, then, are the two ends of the Herbartian pedagogy. In his discussion and extension of Pestalozzi's A B C of Sense-Perception, Herbart affirms that the cultivation of sense-perception falls within the sphere of mathematics, and that mathematical exercises afford the best means of holding the attention of the pupil. In discussing the exposition of mathematics for educative purposes, he declares that nothing seems to lie so nearly at the center of mathematics as trigonometry. Angles, then, should be the first subject for mathematical exercises. A section of seventy-seven pages is devoted to a plan of progressive exercises on triangles, or trigonometry. In a concluding chapter the value of a knowledge of triangles in the study of geography is pointed out, and the transition from the triangular form to the variety of forms in Nature and art is committed to the drawing-master. Wherever in the volume criticisms and expositions of Pestalozzi's work appear, it will be seen that Herbart does not seek to supplant Pestalozzi, but rather to supplement him. In the opinion of the translator, the American school system has had the benefit of Pestalozzianism, and is now ready for the further advance to be had from Herbartianism—in fact, has already entered upon this advance, although, he says, many teachers are guided by Herbart's ideas who never heard of him.

GENERAL NOTICES.

THE rapid march of civilization during the past fifty years has left behind many of the old economic and political ideas. The new crop which has sprung up is not, as was perhaps to be expected, of uniform goodness; and many of them, born of demagogy and ignorance, are positively bad. Ill-considered legislation and mistaken notions of trade and finance have brought about conditions entailing much hardship on the poorer classes; and popular discontent, true to its paternal-government fetich, and constantly stimulated by that persevering animal, the social agitator, is loudly clamoring for "new laws." The most striking political fact during this period has been the growth of the democratic idea, and it is not perhaps surprising that this should be blamed for much of the difficulty. Mr. *Lecky's* book, *Democracy and Liberty*,* is a study of the growth of democratic tendencies, the effect which this growth has had on the treatment of the various economic and political questions, its dangers, ad-

* Democracy and Liberty. By William Edward Hartpole Lecky. New York and London: Longmans, Green & Co. 2 vols., 12mo. Price, $5.

vantages, and probable future, and a comparison of it with other forms of government, more especially parliamentary government with restricted suffrage. It is quite impossible in the space allowed a single review to give any adequate notion of the very wide field which is covered by these two volumes. The work opens with a consideration of English representative government in the eighteenth century, which, with a few modifications, seems to be Mr. Lecky's idea of the best form of polity. The growth of Rousseau's doctrines in France and England and a brief study of the French democracy are followed by about seventy pages on "American Democracy," which, while somewhat tinctured by the proverbial English ingenuousness regarding tales about the wild doings over here, point out the most pronounced of our political faults and weaknesses. Mr. Lecky sums up as follows: "American democracy appears to me to carry with it at least as much of warning as of encouragement, especially when we remember the singularly favorable circumstances under which the experiment has been tried and the impossibility of reproducing those conditions at home." Legislative changes in England, the Irish land question, and the various attempts to legalize attacks on property, successful and otherwise, are discussed in the second chapter. The influence of democracy on individual liberty is shown to be not uniformly favorable, and attention is especially called to the great danger of systems of class legislation, such as the income tax. Aristocracies and upper chambers are given considerable space, including an extended survey of the history of the English House of Lords. The changes which the growth of democracy has brought about in international politics are noted at some length, as is also its effect on religious liberty, Sunday legislation, and marriage laws. In commenting on socialism and labor questions, Mr. Lecky says: "But the proposed changes which conflict with the fundamental laws and elements of human nature can never in the long run succeed. . . . The essential difference of men in aptitudes, capacities, and character are things that never can be changed, and all schemes and policies that ignore them are doomed to ultimate failure." The changes which have taken place in the position and education of women are considered in the last chapter. Mr. Lecky thinks that, owing to their special interests, it is impossible to deny their claim to representation, and that if their demand for the suffrage prove growing and persistent, they will eventually obtain it. As is natural, most of the questions are considered mainly with reference to their bearing on the English polity; but they are questions common to all modern civilized societies, and Mr. Lecky's views, while not perhaps always tenable, are always deserving of attention.

Most of those who have tried it will remember that the study of psychology, aided by the ordinary text-books and carried on after the usual methods of the class room, was about the driest and in many ways the least agreeable of their school-day experiences. Indeed, the study was such uphill work, and had so little that was enticing about it, that the subject was usually put off until the latter part of the school or college course, when it was expected that the more mature minds, especially if backed by a fondness for the science, would be able to struggle through its puzzling abstractions. The book before us* is an attempt to place this study on a better footing. After teaching the subject for a number of years, the author became convinced that there are no such serious difficulties in its pursuit as has been supposed. He found that it can be made attractive, and that, when suitably presented, pupils of average intelligence have little trouble in grasping the essentials of the science. His book is the outcome of this teaching experience, and embodies the plan which the author found most successful in arousing the interest and reaching the understanding of the learner. This plan consists simply in an abundant use of familiar illustrations, with so much of anecdote and of the application of principles as will serve to hold the attention and give the mind of the pupil something tangible to work upon. The illustrative matter is drawn from a great variety of sources, and, as a rule, is very apt.

Mr. Halleck presents his subject from both the introspective and the physiological

* Psychology and Psychic Culture. By Reuben Post Halleck. New York: American Book Company. Pp. 368. 12mo. Price, $1.25.

side, and does not make the mistake of pinning his faith exclusively to one while sneering at the other. He begins by describing "the nervous mechanism at the disposal of the mind," for he regards an elementary knowledge of the action of brain and nerves as a necessary groundwork for the pupil's images of mental action. He then takes up the faculties of mind in succession—consciousness, presentation, representation, imagination, thought, emotion, and will. The several ideas that he sets forth under each subject are contained in distinct paragraphs, each with its own heading.

The scope of the book includes applied as well as pure science. The consideration of each of the faculties above mentioned is followed by a chapter or part of a chapter on the cultivation of that faculty. "Laws are of little use," Mr. Halleck believes, "unless they are applied; hence these chapters are of the utmost importance to all who have not passed the plastic age." He aims not only to show his pupils how the mind acts, but to aid them in making their own minds act more efficiently. The volume is indexed, and the chapter on the nervous system is illustrated with several well-executed woodcuts.

There can hardly be a volume in the Library of Useful Stories that will touch everyday life more closely than *The Story of a Piece of Coal* does.* In telling this story the author has so mingled scientific, technological, and general information about a familiar substance as to produce a remarkably readable little book—one that is instructive without being oppressively learned. He begins with an outline of what has been learned about the formation of coal from plants, and then tells how the coal beds lie among other rocks and what sort of animal remains are found between them. In the next chapter he shows the relationship between peat, lignite, bituminous and anthracite coals, graphite, and the diamond. Passing to the industrial side of his subject, Mr. Martin describes the coal mine and its dangers, the making of gas, and the preparation of those many valuable products derived from what was formerly the waste of the gas works. The derivatives of petroleum, which is closely related to coal, are also dealt with. How long the coal supply of the world is likely to last is a question that has been anxiously asked, and we find some interesting computations of the time in a chapter describing the distribution of the deposits. The closing chapter is devoted to the coal-tar colors, which were briefly referred to earlier in the volume. The thirty-eight illustrations show many of the plants and animals of the coal formations, and some of the structures and apparatus used in mining and gas-making.

President *Jordan*, of Leland Stanford Junior University, has collected into a volume* seventeen addresses relating to higher education which were delivered at college commencements and on other occasions. Several of them have already appeared in print in this magazine and other periodicals. In his address to the class of 1895 of Stanford University, which gives the title to the volume, President Jordan declares emphatically in favor of individual education. "A misfit education," he says, "is no education at all." A training that enables each man to give play to his strength is the best safeguard against the seeming predominance of the weak and ignorant in democracies. Among the subjects whose broad aspects are presented in one or another of these addresses are The Nation's Need of Men, The Higher Education of Women, The Training of the Physician, and The Practical Education. We find in these pages stimulating and luminous thoughts following each other in rapid succession. Thus in one place Dr. Jordan says, after giving words of encouragement to the poor student: "It is not poverty that helps a man. . . . It is the effort by which he throws off the yoke of poverty that enlarges the powers." In another place he warns against mistaking the "cant of investigation" for the true thing. As to a young man's chance for a career, he affirms: "If he can do well something which needs doing, his place in the world will always be ready for him." To

* The Story of a Piece of Coal. By Edward A. Martin, F. G. S. Pp. 168, 16mo. London: George Newnes, Ltd. Price, 1s. New York: D. Appleton & Co. Price, 40 cents.

* The Care and Culture of Men. By David Starr Jordan. Pp. 268, 12mo. San Francisco: The Whitaker & Ray Co. $1.50.

any teacher or student who has native vigor to be aroused, the volume can hardly fail to be an inspiration.

Mr. *Brown's* book* is a revision of his practical taxidermy, published some years ago, plus the results of his work at the Leicester Museum, which includes "new methods, most of which are absolutely novel and at present confined to the Leicester Museum." Although many of the processes are somewhat difficult, the aim has been to so arrange the work as to make its practical application by the learner as simple as possible. The introduction treats of the origin and progress of taxidermy, and the founder of taxidermy certainly Pleistocene in age, is shown to have been the man who first appropriated an animal's hide as clothing, the wearing of skins necessitating some sort of preparation, which may be fairly called taxidermy. The tools and methods used in taxidermy and modeling and the collection of specimens occupy the first four chapters. Then follow special chapters, one on mammals, one on birds, and one on reptiles. The remaining three chapters deal with modeling and artistic mounting. A number of excellent illustrations and a bibliography of the subject add value to the volume.

A magazine entitled *Public Libraries*, devoted to library management and news, was started in May with M. E. Ahern as editor and a strong list of contributing editors. It is to be issued monthly for ten months of the year from the Chicago office of the Library Bureau ($1 a year). Part of the first draft of a Library Primer, to be issued by the American Library Association, is printed in the first number for criticism and suggestions. Other features are news of libraries, library schools, and librarians; notes on reference books for library work; and practical hints.

Prof. *McMaster's* special qualifications, both as a historian and a writer, make his *With the Fathers* (Appletons, $1.50) not only very readable but exceedingly instructive. The volume consists of a series of studies in the history of the United States, all of which have appeared separately in the magazines. The topics treated are The Monroe Doctrine, The Third-Term Tradition, The Political Depravity of the Fathers, The Riotous Career of the Know-Nothings, The Framers and the Framing of the Constitution, Washington's Inauguration, A Century of Constitutional Interpretation, A Century's Struggle for Silver, Is Sound Finance possible under Popular Government? Franklin in France, How the British left New York, The Struggle for Territory, and Four Centuries of Progress.

Betrachtungen eines in Deutschland reisenden Deutschen (Reflections of a German traveling in Germany), by *P. D. Fischer*, is a small book but full. It presents in a succession of brief, terse essays outline descriptions of the various attractions which Germany offers to the traveler and student. These accounts are given under the headings of "How we travel in Germany," "What we can see in Germany" (scenery, people, industries, cities, estates, universities, authors, etc.). "Economical, Moral, and Social Conditions." (Published by Julius Springer, Berlin.)

The thirty-first number of the Standard Teachers' Library contains the *Questions and Answers in Drawing* given at the uniform examinations of the State of New York since June, 1892 (Bardeen, 50 cents). The large number of sketches to be copied with various modifications that are presented in these questions forms a notable feature of the book. The regulations concerning teachers' certificates in force August 1, 1896, are prefixed to the volume.

Prof. *F. Berger* claims as an element of superiority of his *French Method* (1896) over its rivals most in vogue that it takes up the verbs and the grammar at the beginning, introducing the pupil at once to the construction and phrasing of the language, as well as to the use of individual words. It does not, however, make the grammar predominant or teach it in a mechanical way like the old systems that lie unlamented in their graves, but, taking up the idea that inspired the systems that followed these, weaves it in with the life of the language as the pupil learns to use it in informal exercises or the informal turning of well-chosen and familiar

* Artistic and Scientific Taxidermy and Modeling. By Montague Brown. Pp. 452, 8vo. New York: Macmillan & Co. London: A. & C. Black Price, $6.50.

phrases. The book is not large, and will not carry the pupil very far; but, as far as he goes with it, he will be on a solid foundation, and will know what he has learned. (The Author, New York.)

Guns and Cavalry, by Major *E. S. May*, R. A. (Roberts, $1.25), may serve as a text-book for military schools or find a place in the library of any one who has an interest in military affairs. Much of the matter that it contains has been given by the author in lectures at the famous English military school at Woolwich, but little, if any, of it is too technical to be appreciated by the civilian. The work is mainly devoted to the employment of horse artillery, and especially its co-operation with cavalry. The teachings of the book are illustrated by many details of historic battles, some of which are accompanied by maps, and there are sketches of the careers of noted European artillery officers, with portraits of several. In a closing chapter, on machine guns, the author cautions his readers not to expect from any mechanical contrivance what can be accomplished only by courage and skill.

The thirty-eighth volume of the International Education Series is a description of *The School System of Ontario*, prepared by the Hon. *George W. Ross*, Minister of Education for the province (Appletons, $1.50). It includes the general organization of the system, the regulations in regard to school premises, the training and qualifications of teachers, inspection, religious instruction, text-books, libraries, and the special rules concerning high schools and the provincial university. The book is far from being a mere compilation of laws. Thus, in the chapter on the general organization, the policy of having an educational system under the control of a political head is freely discussed, and in various cases the purpose of a regulation or the way in which it has proved to operate is given. Criticisms that have been made upon some features of the system are stated and answered. Since Roman Catholics are more numerous than Protestants in some localities in Ontario and in most parts of the adjoining province of Quebec, denominational schools are a part of the system. The first chapter and the last are historical, describing the rise and growth of Ontario's schools. The volume is offered to educators in the United States in the belief that they will be aided by a study of the plan for popular education that has been worked out by a people of similar origin with ourselves, but who have had a different history.

The *Fifteenth Annual Report of the United States Geological Survey* covers a year following one of reduced appropriations. In the preceding year field work was almost stopped, and the energies of the force were devoted to preparing accumulated material for permanent record or publication. The advanced condition of office work thus obtained and an increase of funds made it possible to prosecute a large amount of field work in the year 1893–'94, nearly all of which was tributary to the preparation of the geologic atlas of the United States. The reports of the director and the chiefs of divisions are accompanied by six papers: On the geology of common roads, by Nathaniel S. Shaler; the Potomac formation, by Lester F. Ward; the geology of the San Francisco peninsula, by Andrew C. Lawson; the Marquette iron-bearing district, by Charles R. Van Hise and William S. Bayley; granitic rocks in the Piedmont plateau, by G. H. Williams; and central Maryland granites, by C. R. Keyes. At the close of the year covered by this volume Major J. W. Powell retired from the direction of the national geologic work which he had carried on for a quarter of a century.

It is an unflattering illustration of the tone of our civilization that President Eliot should have felt called upon to argue seriously in his address at Chautauqua last summer and in the Atlantic Monthly that war is not desirable. The unreasoning outburst of indignation against Great Britain which we have witnessed during the past year does not speak well for the American balance of mind. These facts make peculiarly timely the publication by the Putnams in their Questions of the Day Series of *America and Europe: A Study of International Relations*, which contains three papers bearing directly upon these points by three eminent American publicists. In the first of these papers, The United States and Great Britain, Mr. David A. Wells shows—to our shame that it should

be thought necessary!—that we ought not to hate England, and why; in the second—The Monroe Doctrine—Mr. Edward J. Phelps explains precisely what that doctrine is, and how it does not justify the vaporing which has recently filled our atmosphere; and in the third—Arbitration in International Disputes—Mr. Carl Schurz makes a powerful plea in favor of that principle which President Eliot makes the first among the five great American contributions to civilization.

The Home and School Atlas, by *A. E. Frye*, is intended as a reference book for both the student and the general reader. Its extension maps are well engraved and seem accurate. The relief maps, of which there is a full set, give one an unusually clear notion of topography. The differences in temperature, wind, rainfall, and agricultural products between various sections in the United States are also illustrated by means of maps. A useful pronouncing gazetteer and a list of "statistics of the world" add value to the volume. (Ginn, $1.15.)

The Oswego Method of Teaching Geography is the title of a little teachers' manual by *A. W. Farnham*. The method seems to consist in the main of suggestions to the teacher for interesting the children and expedients for making clear the chief elementary difficulties of the subject. Most of them seem such as any bright teacher would think of, and some are calculated rather to hinder than aid her work, as when, for instance, she is directed to explain the meaning of "down" by the phrase "in a descending direction," or "between" by "in the intermediate space of." The book, at the best, seems not a very necessary one. (Bardeen, 50 cents.)

A new edition of Bardeen's *Common-School Law* is at hand. The book is a valuable one for reference, the frequent reissues keeping it up to date. For this last edition the book has been entirely rewritten, some changes being made in the arrangement, and a new chapter on rules and regulations has been added. (Bardeen, $1.)

PUBLICATIONS RECEIVED.

Agricultural Experiment Stations. Cornell University Station: Suggestions for the Planting of Shrubbery.—Delaware College Station: Milk Sampling.—Illinois University Station: Varieties of Apples.—Iowa College Station: Lamb Feeding; Steer and Heifer Beef, II; Old Process *vs.* New Process Linseed Meal; Notes on Injurious Insects; Fresh Cow *vs.* Stripper Butter.—Massachusetts College Station: The Crambidæ of North America.—New Jersey Stations: The Pernicious or San José Scale.—United States Department: Number and Value of Farm Animals of the United States and Animal Products, and the Principal Household Insects of the United States.

Angling. (The Out-of-Door Library.) New York: Charles Scribner's Sons. Pp. 305. $1.50.

Annuaire de l'Université Laval (Year-Book of Laval University), 1896-'97. Quebec: Augustin Coté & Co. Pp. 192.

Bailey, L. H. The Survival of the Unlike. New York and London: Macmillan & Co. Pp. 515. $2.

Binet, Alfred. Alterations of Personality. Translated by H. G. Baldwin, with Notes and a Preface by J. Mark Baldwin. New York: D. Appleton & Co. Pp. 356. $1.50.

Bödiker (President of the Imperial Assurance Office, Berlin). Le Comte de Chambrun et le Musée Social. Paris: Chamerot & Renouard. Pp. 16.

Bulletins, Catalogues, etc. American Chemical Society Directory of 1896.—Michigan Mining School Catalogue, 1894-'96.—Philadelphia Academy of Natural Sciences, Journal of. Second series, Vol. X, Part IV, 1896, and Proceedings, Part II, April to August.—Philadelphia Board of Education, Annual Report for 1895.—Railways, Statistics in the United States, 1895. Interstate Commerce Commission.—Scientific Alliance, The Sixth Annual Directory, 1896.—Smithsonian Institution Publications: New Species of North American Coleoptera of the Family Scarabæidæ; Observations on the Development and Migration of the Urticating Organs of Sea Nettles, Cnidaria; List of the Lepidoptera collected in East Africa, 1894.—United States Department of Labor, No. 6, September, 1896.

Cairns, T. A. A Manual of Qualitative Chemical Analysis. Third edition, revised and enlarged by Elwyn Waller. New York: Henry Holt & Co. Pp. 417.

Climatological Association of America. Transactions of, for the Year 1896. Pp. 293.

Conway, Moncure D. The Writings of Thomas Paine, Vol. IV. New York and London: G. P. Putnam's Sons. Pp. 521. $2.50.

Crockett, C. W. Elements of Plane and Spherical Trigonometry. New York: American Book Company. Pp., text, 152; tables, 109. $1.25.

Dana, Mrs. W. S. Plants and their Children. New York: American Book Company. Pp. 265. 65 cents.

Education, Report of the Commissioner of, 1893-'94. Pp. 2290.

Field Flowers. Eugene Field Monument Souvenir. Chicago: A. L. Swift & Co. $1.

Gerhard, William P. Theatre Fires and Panics: their Cause and Prevention. New York: John Wiley & Sons. London: Chapman & Hall. Pp. 175.

Halleck, R. P. The Education of the Central Nervous System. New York and London: Macmillan & Co. Pp. 258. $1.

Hertwig, Richard. General Principles of Zoology. Translated by G. W. Field. New York: Henry Holt & Co. Pp. 226.

Hirsch, Dr. William. Genius and Degeneration. New York: D. Appleton & Co. Pp. 330. $3.50.

Howell, William H., M. D. An American Text-Book of Physiology. Philadelphia: W. B. Saunders. Pp. 1052. $6.

Jackson, D. C., and Jackson, J. P. Alternating Currents and Alternating Current Machinery. New York and London: Macmillan & Co. Pp. 729. $3.50.

Johonnot, James. Principles and Practice of Teaching. Revised by Sarah Evans Johonnot. New York: D. Appleton & Co. Pp. 334. $1.50.

Jordan, D. S., and Evermann, B. W. The Fishes of North and Middle America. Bulletin No. 47 of the United States National Museum. Pp. 1240.

Lefevre, Arthur. Number and its Algebra. Boston: D. C. Heath & Co. Pp. 230. $1.25.

Loeffelholz, Carl Freiherr von Colberg. Die Drehungen der Endkruste in geologischen Zeitrāumen (Rotation of the Earth's Crust in Geological Periods). A New Geologico-Astronomical Theory. Second edition, revised and enlarged. Munich. Pp. 247.

Marbut, C. F. The Physical Features of Missouri. Missouri Geological Survey. Pp. 109.

Martin, H. N. The Human Body. Seventh and revised edition. New York: Henry Holt & Co. Pp. 685.

Mathews, William. Nugæ Litterariæ. Boston: Roberts Brothers. Pp. 344. $1 50.

Michigan State Board of Agriculture. Thirty-fourth Annual Report of the Secretary. July 1, 1894, to June 30, 1895. Pp. 900.

Mohr, Charles. The Timber Pines of the Southern United States; and Roth, Filibert. A Discussion of the Structure of their Wood. United States Department of Agriculture, Division of Forestry. Pp. 143.

National Academy of Sciences. Vol. VII. First Memoir on the Bombycine Moths, 1895. Pp., text, 284; plates, 59.

Nichols, E. L., and Franklin, W. S. The Elements of Physics. Vol. II. Electricity and Magnetism. New York and London: Macmillan & Co. Pp. 272. $1.50.

Old South Leaflets. No. 74. Hamilton's Report on the Coinage. Pp. 32.

Parry, C. H. H. The Evolution of the Art of Music. (International Scientific Series.) New York: D. Appleton & Co. Pp. 342. $1.75.

Physical Chemistry, The Journal of. Vol. I, No. 1. Published at Cornell University, Ithaca, N. Y. Pp. 68. Per annum, $2.50.

Pierce, E. Dana. Problems in Elementary Physics. New York: Henry Holt & Co. Pp. 194.

Reprints. Education and Patho-Social Studies. From Report of the Commissioner of Education, 1893-'94 and 1889-'90.—Mills, Wesley A.: Psychic Development of Young Animals. Part II. The Cat. Part III. The Mongrel Dog. Part IV. The Dog and the Cat Compared.—Transactions of the Royal Society of Canada. Second Series. 1895-'96.—Searcy, J. T., M. D.: Insanity in the South. Bulletin American Academy of Medicine. Vol. II, No 9.—The Monitor's Address. Alabama Medical and Surgical Age. June, 1896 – Intoxication and Insanity. Journal of the American Medical Association, September 26, 1896.—Ward, Lester F. The Mechanics of Society (American Journal of Sociology, September, 1896).

Todd, James E. The Formation of the Quaternary Deposits of Missouri (Missouri Geological Survey). Pp. 100.

Torch, The. Vol. I, No. 1 (monthly). The Torch Publishing Company, Memphis, Tenn. Pp. 104. 15 cents. $1.50.

Tzidlkovsky, C. Ballon dirigeable en Fer (Steerable Iron Balloon). Carrying 200 Men and being 210 Metres Long. Plates and Description in Russian and French. Kazan, Russia.

Washington Philosophical Society, Bulletin of. Vol. XII, 1892-'94. Pp. 567.

Woglom, G. T. Parakites. New York and London: G. P. Putnam's Sons. Pp. 88 $1.75.

Youmans, William J. Pioneers of Science in America. New York: D. Appleton & Co. Pp. 308. $4.

Fragments of Science.

Mental Overstrain in Education.—In a recent address before the British Medical Association, under the above title, Dr. G. E. Shuttleworth called attention to some of the harmful results caused by the undiscriminating educational methods of the public schools. He says: "With some so-called educationalists, I fear the idea still lingers that it" (education) "consists of cramming a mind with as much of as many subjects as possible. . . . A smattering of philology, however, will serve to show that the word 'education' means not putting in, but drawing out, and, bearing in mind the physiological interdependence of bodily and mental development, we may say that true education consists in processes of training which will produce in a given individual the most favorable evolution possible of all the faculties both of body and mind. A rational educational system will of course recognize the fact that all children are not cast in the same mold; that there are inherent, often inherited, differences in each pupil's powers, and that, to obtain the best results, instruction must be adapted to idiosyncrasies and proportioned to varying capacities. . . . From the medical standpoint we shall reply in the affirmative to the query of Plato: 'Is not that the best education which gives to the mind and to the body all the force, all the beauty, and all the perfection of which they are capable?' Overpressure in education may in brief be described as a neglect of the principles just set forth—a neglect which can not fail to lead to mental overstrain.

Thus a cast-iron code, imposing for each year of age a definite standard of acquirement, heedless of the varying capacities of children, could not fail to produce it. A disregard of physical conditions underlying mental evolution, and of critical epochs of development (especially in the female sex), affecting capacity for exertion, is another efficient cause, and the undue excitation of the unstable nerve cells of a child of neurotic heredity, to such a pitch of activity as might be harmless in a normal child, will, in the case of the former, be apt to constitute overstrain. Overpressure, indeed, is not an absolute quantity, but has to be estimated in relation to the personal factor in each case. It may, therefore, be defined in terms of educational work as that amount which in a given case is likely to produce excessive strain of the physical or mental system, or both. . . . It has been well remarked that puberty with girls is a period of profound nervous and neuro-psychological import. . . . Many a weak woman could, if she only knew, trace back her weakness to an overstrain at this period of life. There is too often a tendency to subject to serious and exhausting study girls of from twelve to fifteen years of age just at the epoch when they should have the minimum of schoolroom work and the maximum of outdoor exercise and recreation. . . . In these three points, then—(1) excessive hours of study, especially during spurts of growth and development, (2) deficiency of systematic outdoor exercise and recreation, and (3) disregard of physiological functions differentiating the capacity for work at certain times of girls as compared with boys—I think the high-school system needs amendment."

Effects of Labor Legislation.—The significance and tendencies of labor legislation are well summed up by Mr. S. N. D. North in his essay on Factory Legislation in New England, when he says that the whole subject has, in recent years, "shown the unhappy signs of a degeneration into a mere trial of strength between the employing classes and the organized trades-unionism of the operative classes. It has become the popular method of exploiting the assumed antagonism between capital and labor"; and the one certain result of the system as now pursued must necessarily be a constant increase in the intensity of that antagonism. There are also other dangers in such legislation, which the author only refers to. "The public at large has no apprehension of the present tendencies of this legislation. The lawmakers who pass these laws seem to have no well-formed conception of their true scope, function, effects, and limitations. There is apparent no realization anywhere of the fact that they have profoundly modified not only the conditions of manufacturing, but the whole relationship between the State and the citizen engaged in business under its laws. There is underlying them a new doctrine of paternalism more extreme and more excessive than has shown itself in any other phase of democratic government; and the ultimate consequences of its indefinite development are beyond the reach of human ken." A West Virginia court has described them as laws which "assume that every employer is a knave and every employed man an imbecile. . . . There has never been any intelligent and comprehensive study by or in behalf of the State into the practical and economic effects of these laws; and there exists no exact knowledge on the part of those who make them whether they have not already been carried so far as to defeat the objects they are intended to promote."

The Plague of the Mongoose.—The mongoose (*Herpestes ichneumon*) was introduced into the West Indies several years ago as a remedy against the gray rats. It made way with the rats, partly, but not entirely, and still keeps them from multiplying, but has itself become a greater pest. It has nearly exterminated poultry and birds from the islands, is very destructive of turtles' eggs, and is a terror to young pigs, lambs, and kids; it devours all sorts of fruits, sugar cane, fish, wild game, lizards, snakes, crabs, and even extends its depredations to the provisions in the house. One or two species which the farmers valued as vermin-killers have been exterminated by them; consequently ticks are flourishing and increasing fast. The mongooses are exceedingly prolific, bringing forth five or six young at a litter—sometimes ten or twelve—and six or eight litters a year. They live in the hol-

lows of trees and in old walls. They are very active and very intelligent, but their intelligence and activity seem to work always to the harm of the farmers and housekeepers. A merchant observed a venerable old mongoose in his warehouse, and set a trap for it. He put a hen's egg in a position to be well seen as bait, and under it concealed a spring trap, right in the animal's road. The mongoose burrowed under the trap, threw it out of gear, and managed so that the egg rolled down to him. Yet some mongooses are taken in traps, but not one in twenty of them are females. The females are too busy taking care of their families to be running round; and it is supposed that the males in their depredations, besides satisfying their own wants, provide for those of their mates at home.

The Sympsychograph.—The *Revue Scientifique* concludes a summary of Prof. Jordan's remarkable account of the sympsychograph in the September number of the Monthly with the remarks: "All this is very ingeniously constructed—text and photograph—and falls in no way short in logic and reasoning of the habitual lucubrations of the spirits: it is quite as plausible as a hundred stories that have been told to us in all seriousness. The only difference is that Mr. Jordan has been amusing himself, and his whole account is pure invention. The 'astral cat' exists only in his imagination, as the 'astral body' of the spirits is also undoubtedly imaginary; but Mr. Jordan knows this, while the spiritualists do not recognize it. As a satire the story is very amusing; but it is certain that some persons will take it seriously, and this will be not the least amusing thing about it."

The Fascination of Cycling.—In the effort to account for the absorbing and enduring pleasure of bicycling, which induces men and women to spin for hours every day over the same roads, with no apparent diminution of their enjoyment, M. Ph. Tissier adduces associations of ideas corresponding with the frequent and quick changes of attitude to which the wheelman is subject. There is a limit, however, to these changes of position, and it is not so far off but that they will become tiresome long before the bicyclist becomes in fact tired of wheeling. M. Ch. du Pasquier, in the *Revue Scientifique*, looks for the origin of the bicyclist's delight in the pleasure of motion, augmented by the rider's sense of control and mastery of the instrument and of himself. The experiments of Feré have proved that motion introduces very real effects into our organisms. It gives a kind of new force, and increases the effect of an excitant, in proportions bearing an approximate relation to its rapidity. This force-giving action explains many other things not otherwise accounted for—such as the pleasure of riding rapidly in a carriage, of getting up into a high place, and the delight we take in games of strength and skill, in agile exercises, wrestling, racing, combats, etc. The activity begotten of the exercise operates as a further stimulant; and so the rider goes on, with the breezes fanning his cheeks, his whole organization, as Gratiolet observes, "singing in various tones a hymn of satisfaction and joy," till he is in danger of exhaustion before he realizes that he is becoming tired. In this last condition lies the great danger of excessive cycling, which can not be too carefully guarded against. M. du Pasquier finds a serious defect in cycling in its monotonous character. It is far excelled, in his opinion, in variety of motions and tensions by horseback riding, tennis, and fencing, which, besides bringing all the muscles of the body into play, enforce the participation of the mind—of attention, judgment, and decision. The movement in cycling is stupidly regulated by the mechanism, which permits no further extension or flexion of the limbs or the body; the motions are all alike in infinite repetitions, at least so long as the "spin" endures. It follows that the mental action can not be very elastic and the mental images will not be lively or varied. The impressions the cyclist receives are correspondingly monotonous. Those thoughts can not produce anything of value which are occupied with the road that has been passed over, with the miles that are yet to be covered, and the time when the rider will get to his destination; which are intent on keeping the record he has made, or upon creating a new one. Feré's remark bears upon this point that "the effect of systematized excitation on a small number of ideas is always bad," and that it is not healthy for the mind to be inactive in

other directions than that on which it is most intently bent. So much for "excess" in bicycling; for devotion to the machine for itself; for "scorching." But of moderate use of the machine, of its employment as an aid to other exercises and recreations, MM. Tissier and Du Pasquier would probably have, certainly ought to have, quite other views.

Cement as a Fire-proof Covering.—Mr. J. S. Dobie has recently published the results of a number of tests showing the effect of heat on cements. Tests were made upon pure briquettes and briquettes made up of sand and cement in various proportions. The briquettes were heated in a small assay furnace. The first thing noticed on removal from the furnace was a loss of weight, and the pure cement briquettes almost invariably showed extensive cracks. The loss in weight is due to the driving out of the water of crystallization, hardened cement consisting of hydrated crystals of aluminum and calcium silicate. After removal from the furnace, the briquettes were subjected to various tests, and in every case where the water of crystallization had been approximately all driven off the briquettes were unable to resist any load whatever. A high temperature was not necessary to destroy the strength of the cement. The lowest heat which could be generated by the furnace, considerably below red heat, was found to be as destructive as the highest temperature. The conclusions arrived at by Mr. Dobie were: 1. That while there is no doubt that a covering of Portland cement concrete will afford some protection to a metal column or girder, still there appears to be no doubt that the concrete itself will be ruined by the action of the fire, and will have to be removed as soon as the fire is subdued. 2. The concrete covering, if heated, will not stand the action of water. In a case of fire, when the hose is turned on, the water strikes the cement covering, probably red hot, and immediately cracks it off, leaving the ironwork bare. 3. In calculating for the design of the columns and girders, and especially for floors, no allowance should be made for the strength of the concrete, and the cement covering should be considered as so much extra load on the system. 4. That in a fireproof building floors should never be constructed of slabs of cement forming short spans or arches from girder to girder, without any support, and that these experiments indicate that the value of concrete as a fire-protecting material has been greatly overestimated, and that disastrous results may follow, from confidence in a building protected with such material.

Chinese Medicine.—The medicine of the Chinese is described by M. Paul d'Enjoy as being more serious, more widely extended, and further removed from superstitious practices than that of the other cognate peoples of the far East. The doctors concoct and sell their remedies, as well as prescribe them, provide themselves with luxurious shops, and use all the tricks of the trade to make their parcels attractive. Many of their remedies are administered in large, badly tasting pills, only slightly mollified in their flavor by licorice. These pills are inclosed in capsules of wax as large as pigeons' eggs, which preserve the compound from contact with the air, and are broken when the remedy is taken. Special preparations are sent out from the large shops of the principal commercial centers. Among the most popular of the specialties are the little brick-red cholera pills, composed of mangosteen bark and various tropical essences, such as santal, eaglewood, and calumba. The *Dau-nhu y* is a medicinal oil which produces excellent effects in headaches, and generally in cases of brain weariness of every kind. It is rubbed on the temples, and is inhaled by strong breathing, after having been rubbed upon the nostrils. Relief is obtained through the cold which its evaporation quickly produces. The basis of the preparation is camphor; and, as a whole, its effect may be compared to that of the headache pencils familiar in our drug stores. Chinese medicine is chiefly based on plants, and is taught in books which are often very ancient. In his practice the doctor strictly follows the methods of the master by whom he has been taught. With a very grave face, his eyes protected by large spectacles of thick glass, the old physician feels the pulse of his patient, and never fails to make him show his tongue. Next he examines his eyes, and asks a series of questions, the answers to which will help him out in his diagnosis. Then he writes his prescription

on a sheet of rice paper and hands it to his pupil, who proceeds to compound it. Generally the prescription is made from the directions in some book, which are simply referred to by name or number. The pupil goes to the book for the directions. The seeds, herbs, leaves, and stems, the essences of which are to be combined to form the remedy, are generally weighed out or measured, and given to the patients with directions to boil them at home with a prescribed quantity of drinking water to a measure which is exactly indicated: "Put all these plants into an earthenware pot with a large glass of water and boil them over a bright fire down to a teacupful; then strain carefully and drink hot." The remedies are all taken in bed, and rest, or sleep, if possible, is recommended The potions as administered have very powerful effects.

Talismans.—The word talisman—a corrupted Arabic term, which has come to us through the Moors and France—means properly a figure or thing endowed with magical powers, which enables its possessor to summon supernatural beings to his aid, whether to defend him in a hard strait or to realize some great wish. The existence of such things is an Arab belief probably older than Mohammedanism, and has for its origin a profound Semitic belief in created beings of a much higher class than man, who might, under certain persuasion or compulsion, be induced to give him the aid of their loftier prerogatives. The superstition of talismans has been made familiar by the Arabian Nights, is probably as wide as the world, and lingers still, even among the cultivated classes of Europe, to an extraordinary extent. It is doubtful "if there is a dynasty in the West which does not possess some article—usually a jewel or a sword—which the vulgar believe to be its 'luck' or source of fortune, and which the owners themselves, while theoretically rejecting the belief as nonsense, would be vexed to the very heart to lose. . . . The relation of the picture, usually the founder's portrait, and the sword to the founders of the house has, indeed, passed into literature, and is one of the few bits of supernatural machinery which do not excite the ridicule of modern readers." Seeking its mental origin, a writer in the London Spectator finds that it is utterly opposed to the spirit of all the greater creeds, which, except perhaps Hinduism, make fortune dependent on conduct or the favor of the Almighty, or both. "There is, no doubt, in Hinduism a lurking idea, to which a profound student of the East like Sir Alfred Lyall attributes great importance, that any inanimate thing which is exceedingly odd or separate must be in some sense divine. The notion is that Nature produces only the usual, and that everything unusual must be the product of special interference from the creating power, and therefore possess some portion of the divine spirit, or at least some influence emanating from an unusual source." This does not account, however, for the prevalence of the idea in Europe and among people of a skeptical turn. There is nothing like the notion of consecration connected with the talisman—it may even be supposed to have come from the devil—nor is there anything in the idea akin to astrology. The writer we have cited suggests that the origin sought for may lie in men's "lingering belief in Destiny as a force apart from Providence, a power having its origin, not in design, but in the very nature of things. . . . If a man thus believing that Destiny pursues him for good or evil once admits the idea, however irrational, that an inanimate substance is connected with his destiny, the substance becomes the 'talisman' of which we have been speaking, and he can not endure either to lose it or to see it injured. His brain may reject the superstition with utter scorn, he may even be angry with himself for giving it five minutes' attention, but an inner faith in it—if we may so desecrate the word 'faith'—as strong as the faith of some men in omens, forbids him to disregard the 'talisman.' The faith again would, of course, like the faith in omens, be greatly strengthened by accidental coincidences, but it survives the want of them, and sometimes, we suspect, the occurrence of events entirely at variance with the secret belief."

Science-Teaching in Secondary Schools.—The summaries of a series of conferences concerning teaching in secondary schools held in 1893 under the direction of the National Council of Education, and published in the last report of the United States Commissioner of that department, contain valu-

able suggestions on the teaching of mathematics and the sciences. The conferences consisted each of ten members, selected on account of their scholarship and experience, and discussed the questions submitted to them with much thoroughness. The conference on mathematics recommends that the course in arithmetic be at once abridged by omitting the subjects which perplex and exhaust the pupil without contributing valuably to his mental discipline, and enriched by a greater number of exercises in simple calculation and in the solution of concrete problems; that instruction in concrete geometry, with numerous exercises, be given in connection with drawing; and that in demonstrative geometry, as well as in all mathematical teaching, great stress be laid on accuracy of statement and elegance of form, as well as on clear and rigorous reasoning. In physics, chemistry, and astronomy the conference urges that the study of simple natural phenomena be introduced into elementary schools, and that at least one period a day from the first year of the primary school should be given to such study; emphasizes the necessity of a large proportion of laboratory work in the study of physics and chemistry, and advocates the keeping of laboratory note-books by the pupils, and the use of such note-books as part of the test for admission to college. More work, it is held, is required of the teacher to give good instruction in the sciences than to give good instruction in mathematics or the languages. The conference on natural history advises that the study of botany and zoölogy be introduced into the primary school course, and be pursued steadily, with not less than two periods a week, throughout the whole course below the high school. In the early lessons no text-book should be used, but the study should be constantly associated with the study of literature, language, and drawing. Physiology should be postponed till the later years of the high school, and in the high school some branch of natural history proper should be pursued every day throughout at least one year. The value of laboratory work and of the cultivation of exact, elegant expression in description is again insisted upon. The most novel suggestions are given in connection with the teaching of geography, of which the conference takes a far more comprehensive view than the usual one, and which it evidently regards as including the whole physical environment of man, and as requiring a knowledge of many of the elementary facts of the other subjects. Meteorology may be taught as an observational study in the earliest years of the grammar school.

Hereditary Crime.—An interesting investigation is reported by Prof. Pellmann, of Bonn University (Germany). He has made a special study of hereditary drunkenness, which, in the case of a certain Frau Ada Jurke, he followed through several generations. She was born in 1740, and was a drunkard, tramp, and thief for the last forty years of her life, which ended in 1800. Her descendants numbered 834, of whom 709 have been traced in local records from youth to death. Of the 709, 106 were born out of wedlock. There were 142 beggars and 64 more who lived upon charity. Of the women, 181 led disreputable lives. There were in this family 76 convicts, 7 of whom were sentenced for murder. Prof. Pellmann says that in seventy-five years this one family rolled up a bill in the almshouses, trial courts, prisons, and correctional institutions of $1,250,000. With such a record before it, the state seems justified in adopting measures for preventing the breeding of such characters.

The Newspaper and Periodical Industry.—A recent article in the Hartford Times gives some interesting semi-statistical figures regarding the newspaper industry in the United States. It estimates that there are about 2,100 daily and over 1,100 weekly newspapers and periodicals published in the United States, besides the hundreds of monthly magazines, reviews, and trade journals. "It is probably a low estimate to say that there are 100,000 men and women occupied in their production. Adding to these figures the people employed in the various printing establishments and publishing houses, we should have a total of about 250,000, and including those dependent on them, probably more than a million of the population who are thus supported. Nearly every newspaper has one or more presses, costing thousands of dollars each; $50,000,000 would not begin to pay for the printing presses now

in operation in the United States. We are within bounds in estimating the daily issues of the newspapers in the United States at more than 20,000,000 copies. If the publishers receive on the average as much as five dollars per year for their circulation from each subscriber or patron, we have more than $100,000,000 paid in from that source. Giving the weeklies an average of only 2,000, and we have nearly 25,000,000 subscribers to them, and at the average price of one dollar there is $25,000,000 more. We should think the total receipts from sales and subscriptions over rather than under $150,000,000. Now we come to the matter of advertising, which is probably nearly twice the amount paid in subscriptions—nearer $300,000,000 than $200,000,000. If it is only $250,000,000, we have an aggregate of $400,000,000 passing over the counters of the newspaper offices of the country each year."

MINOR PARAGRAPHS.

GELATIN has the curious property of becoming insoluble and stiff when exposed to formic aldehyde, while it resists the action of water, acids, and alkalies. In this stiffened condition it is like celluloid without being inflammable. Advantage is taken of this property in making statuettes and trifles of the carver's art. To make these objects, gelatin, having stood overnight in water, is melted in the marine bath, then mixed with formic aldehyde, and poured into molds of plaster, clay, or metal, cooled, and, when taken out of the mold, dipped in a concentrated solution of formic aldehyde, or, if large, painted with it. The transparency of the gelatin is remedied by adding, previous to molding, a little zinc white in water and alcohol, with which, if it is desired, coloring substances may be incorporated.

TWENTY or more industries are enumerated in the report of a committee appointed by the British Home Secretary to inquire into the subject as "dangerous trades." Each of them has its special risk, ranging from discomfort that ultimately works harm to immediate peril. In the manufacture of India rubber the constant and all-pervading presence of naphtha, in which all the material has to be dissolved, is an effective agent of mischief. Still, no special illness is known to be produced by the fumes of naphtha, but, besides being unpleasant, they tend to undermine the constitution. The bisulphide-of-carbon process for vulcanizing India rubber is more positively dangerous, and sometimes, according to the report, leads to insanity. Other dangerous trades mentioned are that of "dry cleaning," in which fire and the inhalation of volatile spirits are elements of peril; working in bronze, which induces skin disease and slow poisoning of the system; mica-dusting, at which a boy seldom continues more than six weeks; and the manufacture and use of inflammable paints.

IN order to determine whether calm sea air contains appreciable quantities of salt, M. E. Chaix, of Geneva, visiting the island of Jersey, drew air in quantities of one thousand litres at a time and stirred it in a solution of nitrate of silver. The solution was not made turbid in any of the experiments. The air, therefore, held no salt. Hence it seems certain that all the salt that may be floating in the atmosphere is that derived from the spray blown in by the winds and held temporarily in mechanical suspension. It does not volatilize in the air, and never becomes a real constituent of it. Persons going to the seaside "for the sake of the salt air" would therefore do well to avoid the calm, quiet places, and seek those which are more or less windy.

BELIEVING that the current estimates of the velocity of flight of pigeons were not founded on sufficiently accurate data, Mr. C. B. Keene adopted the plan of having the birds released at a given distance away and a given moment, and observing the time of their arrival at their home. He found that, while some birds could maintain a speed of about 1,170 yards a minute, the speed of the majority, or 73 per cent of those observed, was between about 860 and 1,170 yards a minute. The highest speed observed by him of young pigeons was about 1,362 yards a minute. M. Felix Rodenbach, who has

also made careful observations, believes in the possibility of pigeons flying 72 miles an hour. Observation shows that they fly perceptibly faster than the best express trains. Their speed, in M. Rodenbach's view, is even much greater than it appears; for they can not fly in a straight line as the express train runs, but are obliged to make zigzags and detours, as they meet or are turned by varying currents in the air.

THE Gas Exposition to be held in Madison Square Garden during the two weeks beginning January 25, 1897, will be the first affair of the kind attempted in this country, although such displays are a regular feature of the year's entertainments in some European countries. The exhibition will be managed by a board of directors composed of men well known in the commercial and financial world—many of them connected with gas enterprises, and some distinguished in science and public life—assisted by an executive committee. It is represented that a large and increasing interest is being taken in the project by men and firms whose cooperation is desired, and who might be counted upon to become exhibitors. It would be impossible to name all or even a considerable fraction of the features which could find an appropriate place in such an exhibition. Great improvements are being made in the use of gas for light and fuel and the appliances, and these will, of course, be shown.

MR. AMOS W. BUTLER, the well-known ornithologist, gives, in his address as retiring President of the Indiana Academy of Sciences, an interesting and valuable contribution to our knowledge of contemporary evolution. The address, published by the Academy, treats of "a century of changes in the aspects of Nature" in Indiana. The disappearance of the great forests, the extinction of the Indian and the large mammals, have been accompanied by corresponding changes among the smaller animals. Especially notable has been the loss of the hosts of passenger pigeons. In the days of Wilson and Audubon the sky was literally dark with these. Now the species is but a memory, so far as Indiana is concerned. The future will record changes as the past has done. "But at no time in the future will the changes in the aspects of Nature be so noticeable, so incomprehensible, because of their vastness, as have those of the century just closing."

FOLLOWING the protest which some time ago appeared against the illustrations of impossible icebergs comes one against impossible volcanoes. Mr. Oliver C. Farrington writes to Science, sending a reproduction of a school geography's picture of Popocatepetl, and by the side of it an outline of the actual mountain. The difference is quite startling. The slope of Popocatepetl was found by Mr. Farrington to be never more than 30°, while the picture represents a snow-capped peak with a slope of from 40° to 50°. "A tall cross, such as no traveler in Mexico ever saw, and luxuriant palms, such as never grow at the altitude from which Popocatepetl can be seen," furnish a fitting foreground.

NOTES.

THE experiment of planting and raising Eastern oysters in the waters of Los Angeles County, California, was tried in 1892, when three hundred pounds of spat or seed oysters were planted at Alamitos Bay, near Long Beach Park, and at the mouth of New River. At the end of 1894 the oysters of this plantation were as large as those of the same age raised in the East. The oyster ground embraced the whole of Anamitos and Anaheim Bays. The outlook for the industry was hopeful, and no starfish or carnivorous shellfish had been detected among the beds. Mrs. M. Burton Williamson, who has published an account of this plantation in the Annual of the Historical Society, suggests that the shipment of Eastern oysters may also result in planting the fry of other shellfish from the East in the bay. *Mya arenaria* and *Urosalpinx cinerea* are now propagated in San Francisco Bay from seed brought with Eastern oysters.

TOPAZES are found in the tin-bearing alluvions of the river Tjenderiang in the kingdom of Perak, Malacca, absolutely colorless and perfectly transparent, measuring from one centimetre to three centimetres and a half. Sometimes they are rolled, when their faces are dull, but the number of intact crystals is large enough to justify the supposition that their original site is not far away.

THE recent conference held in London, for considering the question of forming an international catalogue of scientific literature, should have very important results. Men of science recognize, as Prof. Mach, of Germany, said, no distinction of race or nationality, and they were glad, he added, to

co-operate with Englishmen in a work in which all men of science were interested. The cataloguing of general scientific work, as it at present stands, is not at all satisfactory, and the adoption of a general system, by the scientists of all countries, which seems likely to follow the conference, will undoubtedly be a long step in advance.

THE excessive cost of the rare earths used in the composition of the Welsbach and other incandescent gas mantles has led to the formulation of a process by which the residues of the old mantles can be reduced, separated, and used again repeatedly in new mantles. The process consists in reducing the mantles with ten times their weight of bisulphate of sodium, taking up the product in water, and adding excess of oxalate of ammonia to redissolve oxalates of thorium and zirconium, while the oxalates of cerium, lanthanium, erbium, and yttrium remain insoluble. The liquor is then filtered, the undissolved oxalates remaining on the filter. The residue is then treated with concentrated hydrochloric acid to obtain the oxalates of thorium and zirconium.

THE supposition that by comparing numerous elements in different myths, and thus discovering that many are identical, a common origin is proved, was treated as a fallacy by Dr. Brinton in a paper read before the American Association. The method in question, Dr. Brinton held, does not take into account the essential unity of the human mind, wherever it may be, and the laws that govern its activity. Because of the tendency of the mind, everywhere and in all conditions, to act in the same manner, we find myths of similar character in all parts of the world. They may therefore be very similar, and yet very diverse in origin.

A SERIES of fifteen terminal moraines was described by Mr. F. B. Taylor, in a paper read in the American Association, as lying between Cincinnati and the Straits of Mackinaw.

THE cultivation of flowers for export and for the perfumery factories at Grasse is an important industry on the Riviera. It is officially estimated that the value of flowers annually exported from Nice, Cannes, Beaulieu, and Mentone is six hundred thousand dollars.

PROF. JOSIAH DWIGHT WHITNEY, of Harvard University, one of the most eminent of American geologists, died at Lake Sunapee, N. H., August 19th, in his seventy-seventh year. He was born in Northampton, Mass.; was graduated at Yale in 1839, and, after spending about twenty years in various geological surveys, was appointed Professor of Geology at Harvard in 1864. His geological work began in service as assistant geologist in New Hampshire, subsequent to his graduation, after which he traveled and studied in Europe. In 1847 he engaged, in connection with John W. Foster, in the Government survey of the Lake Superior region, the published result of which, Foster and Whitney's Report, was a famous book in its day and long the chief authority. He next spent two years in the examination of the mining and mineral resources of the States east of the Mississippi, and published The Metallic Wealth of the United States in 1854. He next became State Chemist and professor in the State University of Iowa; made a geological survey of that State; surveyed the lead region of the upper Missouri, in connection with the official surveys of Wisconsin and Illinois; and from 1860 till 1874 conducted the topographical, geological, and natural-history survey of California, publishing the results in more than six volumes. He translated the Use of the Blowpipe of Berzelius, published a Yosemite Guidebook, and contributed much to scientific and other periodicals. Mount Whitney was named after him. He was a brother to William Dwight Whitney, the philologist.

AMONG the results of the measurements of the velocity of rotation of the planets by the spectroscopic method reported by Prof. J. E. Keeler to the British Association is the observation that the inside of Saturn's ring moves more quickly than the outside, and consequently that the constituents of the ring do not obey Kepler's third law. These constituents are therefore not solid particles, a fact which has been previously established by other methods.

MR. WILLIAM CRAWFORD WINLOCK, assistant in charge of the office of the Smithsonian Institution, died at Bay Head, N. J., September 20th, in his thirty-seventh year. He was a son of Prof. Joseph Winlock, first Director of the Harvard Observatory and Superintendent of the American Ephemeris and Nautical Almanac, and inherited a fondness for astronomy from him. He was appointed curator of international exchanges and afterward assistant in charge of the office of the Smithsonian Institution; prepared the Annual Reports on the Progress of Astronomy from 1885 to 1892; contributed articles on astronomy to various periodicals; and represented the Secretary of the Smithsonian Institution at various scientific meetings, including the centennial anniversary of the American Philosophical Society.

DR. H. NEWELL MARTIN, ex-Professor of Biology in Johns Hopkins University, died in Burley, England, October 29th, in the forty-ninth year of his age. He was born in Newry, Ireland; was a fellow of Christ College, Cambridge, where he received the degree of A. B. in 1879, and that of A. M. in 1877; and was appointed to the professorship in Johns Hopkins on the recommendation of Prof. Huxley. He retired from that position in 1893 on account of ill health.